# MARKET COMMENTARY

## proceedings of the canadian agricultural outlook conference

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# Proceedings of the Canadian Agricultural Outlook Conference
December 1985

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# Foreword

The 1985 Canadian Agricultural Outlook Conference was its 51st meeting. The theme of the Conference, held in Ottawa on December 9–10, was "Agricultural Resources for the Future". The theme recognizes the growing importance of preserving and enhancing Canada's natural resource base to ensure Canada's long term growth and competitiveness in international markets.

Presentations of a special plenary session on the Conference theme are included in these proceedings. These presentations provide valuable information to aid in a better understanding of situation and future prospects of agriculture resources in Canada and other exporting countries. The proceedings also include plenary session outlook papers and special invited presentations in the simultaneous commodity and farm input and income sessions.

More detailed information relating to specific commodities are found in the December 1985 Market Commentary (containing the outlook for Grains and Oilseeds, Animal and Animal Products, Milk and Dairy Products and Horticulture and Special Crops), Market Commentary: Farm Inputs and Finance and the Food Market Commentary.

H. Bruce Huff
Director
Commodity Markets Analysis Division
Marketing and Economics Branch

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# 51ST ANNIVERSARY
# 1985 CANADIAN AGRICULTURAL OUTLOOK CONFERENCE

## DECEMBER 9 AND 10, 1985
## GOVERNMENT CONFERENCE CENTER, OTTAWA

**MONDAY, DECEMBER 9, 1985**

08:30 **Registration**

Conference Chairman: J.P. Connell
Deputy Minister
Agriculture Canada

Conference Theme: **"Agricultural Resources for the Future"**

**PLENARY SESSION I**

Session Chairman: J.P. Connell
Deputy Minister
Agriculture Canada

09:00 **Opening Speech**

The Honourable John Wise
Minister of Agriculture
Agriculture Canada

09:30 **Situation and Outlook for Agricultural Soil Resources in Major Food Exporting Countries**

Pierre R. Crosson
Resources for the Future
Washington, D C

10:00 **Implications of Present Situation and Outlook for Agricultural Natural Resources in Canada**

Don Rennie
University of Saskatchewan

10:30 Break

11:00 **Towards a Long Term Strategy**

R. Bailey
Assistant Deputy Minister
Regional Development Branch
Agriculture Canada

*and*

H. Hill
Director-General
PFRA

11:30 **Question Period**

12:00 **Banquet**
The Honourable H. Schroeder
B.C. Minister of Agriculture and Food will speak on :
"Food Pacific 86" during the Banquet

**PLENARY SESSION II**

Session Chairman: Y. Jacques
Assistant Deputy Minister
Marketing & Economics
Branch
Agriculture Canada

14:00 **Presentation of the General Economic Outlook**

L. de Bever
Vice-President and Country Manager
Chase Econometrics Canada

14:30 **World Agricultural Outlook**

Jim Donald
Chairman of the World Board
USDA, Washington

15:00 **Canadian Agricultural Outlook**

H.B. Huff
Agriculture Canada

15:30 Break

16:00 **Farm Income Outlook**

B. Perkins
Agriculture Canada

16:30 **Questions to Speakers**

**Evening**

18:00–20:00 **Foreign Agricultural Attachés' Reception**

**TUESDAY, DECEMBER 10, 1985**

**PLENARY SESSION III**

Session Chairman: J.P. Connell
Deputy Minister
Agriculture Canada

14:00 **Dialogue with the Minister**

The Honourable John Wise
Minister of Agriculture
Agriculture Canada

15:00 **Closing Reception: "Gifts from our Land"**

## CONCURRENT SESSIONS

**December 10th**


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| 09:00-12:00 | Dairy – Colonel By Room | 7 |
| 09:00-12:00 | Horticulture and Special Crops – Rideau Room | 8 |
| 09:00-12:00 | Farm Costs and Income – Centennial Room | 9 |
| 09:00-12:00 | Food – Gatineau Room | 10 |
| 09:00-12:00 | Agricultural Soil and Water – Room 103 | 11 |


### LIVESTOCK AND POULTRY

(Main Hall)

Session Chairman: J. Drew
Deputy Minister
Saskatchewan Department of Agriculture

08:30 **Feed Grain Summary**
C. Fulton
Agriculture Canada

08:40 **Poultry Outlook**
D.B. Murray
Agriculture Canada

09:00 **Hog Outlook**
L. Young
Agriculture Canada

09:20 **Beef Outlook**
A. Boswell
Agriculture Canada

09:40 **Outlook Panel**
(All Outlook Speakers)

10:00 Break

10:15 **Prospective Resource Developments for Canada's Meat Industry (Beef, Pork, Poultry)**
L. Martin
Guelph University

COMMENTS ON ABOVE PAPER

10:45 **Beef**
Chris Mills
Alberta Cattle Commission
Calgary, Alberta

11:00 **Hogs**
Howard Malcolm, President
Canadian Pork Council
Ottawa, Ontario

11:15 **Poultry**
Ralph Barrie
Vice-Chairman
National Farm Products Marketing Council
Ottawa, Ontario

11:30 **Panel and Discussion Period**
(All Speakers)

### GRAINS AND OILSEEDS

(Sussex Room)

Session Chairman: B. McEwen
Deputy Minister
Alberta Department of Agriculture

08:40 **Chairman's Remarks**

08:45 **Wheat Outlook**
Patti Miller
Agriculture Canada

09:05 **Coarse Grain Outlook**
Brian Paddock
Agriculture Canada

09:25 **Oilseed Outlook**
Hans Duncker
Agriculture Canada

09:45 **Comment on Outlook**
Brian Hayward
United Grain Growers

10:05 Break

10:25 **Questions on Outlook**

10:40 **An Economic Evaluation of Cereal Crop Rotations in the Prairie Provinces**
R. Schoney
University of Saskatchewan

11:00 **Implications of the Seasonal Variability of Soil Erosion on Crop Production**
G.R. Mehuys
MacDonald College

11:20 **Questions**

11:30 **Food Aid and Agricultural Trade**
David Hutton
CIDA

11:50–12:00 **Questions**

## MILK AND DAIRY PRODUCTS

(Colonel By Room)

Session Chairman: J. Tim G. Andrew
Deputy Minister
New Brunswick Department of Agriculture and Rural Development

09:00 **Dairy Outlook**

R. Tudor Price
Agriculture Canada

09:30 **Reply to Outlook**

Raymond Cloutier
Quebec Department of Agriculture, Fisheries and Food

10:00 Break

10:30 **The Potential Impact of Bovine Growth Hormone on the Productivity of Dairy Cows**

Denys Petitclerc
Agriculture Canada

and

Ghislain Pelletier
Agriculture Canada

11:00 **Inspection of Canadian Dairy Products**

Peter Brackenridge
Agriculture Canada

## HORTICULTURE AND SPECIAL CROPS

(Rideau Room)

Session Chairman: G.A. MacEachern
Deputy Minister
British Columbia Department of Agriculture and Food

09:00 **Market Outlook for 1986 and Beyond**

***Fruit***
***Raspberry Potentials for Growth***
Cornie H. Penner
B.C. Raspberry Growers Association

***Vegetables***
***Storage Vegetable-Marketing Potentials***
Florian Sedillot
SCA du sud de Montréal

***Floriculture***
***Market Expansion Potentials***
Herb Van der Ende
Burnaby Lake Greenhouse
British Columbia

***Commodity Overview***
***Outlook for 1986***
Nelson Longmuir
Agriculture Canada

10:15 **Discussion**

10:30 **Resources for the Future – Resource Requirements for Expansion of Fruits and Vegetables**

Danny Dempster
Vice-President
Canadian Horticultural Council

**Commodity Councils for Growth – Apples**
Laurie Hennigar, President
Blomidon Farms Limited
Nova Scotia

11:15 **Discussion**

## FARM COSTS AND INCOME

(Centennial Room)

Session Chairman: R. Carré
Assistant Deputy Minister
Quebec Department of Agriculture, Fisheries and Food

09:00 **Input Situation and Outlook**
Lars Brink
Agriculture Canada

09:20 **Provincial Income Outlook**
Wayne Jones
Agriculture Canada

09:40 **The Management Resource in Farming**
P. Ehrensaft
Université du Québec à Montréal
and
R. Bollman
University of Manitoba

10:00 **Questions**

10:20 Break

10:40 **Farming with Low Levels of Purchased Inputs**
David Pimentel
Cornell University

11:00 **Soil Conservation, Dryland Farming and the Farm Machinery Industry**
Dale Shepherd
Morris Rod-Weeder Company Limited
Yorkton, Saskatchewan

11:20 **The Role of the Input Supplier in the Sustainable Management of Soil and Water**
Bob Weese
Plenty Farm Sales Limited
Plenty, Saskatchewan

11:40 **Questions**

## FOOD

(Gatineau Room)

Session Chairman: G. Gartner
Deputy Minister of Agriculture
Manitoba Department of Agriculture

09:00 **Situation and Outlook for Food Prices**
Gordon Richardson
Agriculture Canada

09:20 **Situation and Outlook for Food Processing and Retailing Sectors**
Don West
Agriculture Canada

09:40 **Response to the Outlook**
Murray Hawkins
University of Alberta

09:50 **Questions**

10:00 Break

FOOD IN THE 80'S – NEW PRODUCTS, NEW STORES, NEW EXPERIENCES

10:30 **New Stores**
Tony Wilshaw
President
Canadian Federation of Independent Grocers

10:50 **New Products**
Marilyn Knox
Vice-President
Grocery Products Manufacturers of Canada

11:10 **New Experiences**
Bob DeGrace
PresidentCanadian Restaurant and Food Service Association (CRFA)

11:30 **Questions and Discussion**

## AGRICULTURAL SOIL AND WATER

(Room 103)

Session Chairman: C. Switzer
Deputy Minister
Ontario Department of Agriculture and Food

09:00 **The On-Farm Economics of Soil Conserving Production Practices – Situation and Outlook**
M. Colwell
Agriculture Canada

09:40 **The Role of the Agri-Business Sector in Addressing Agricultural Resource Degradation**
Richard R. Johnson
John Deere Ltd.
Moline, USA

10:10 Break

10:30 **The Situation and Needs for Conservation Farming – Producer Perspectives**
L. Bishop
Farmer
New Brunswick

G. Gras
Farmer
Quebec

D. Lobb
Farmer
Ontario

D. Connick
Farmer
Saskatchewan

11:40 **Wrap-up of Conference Theme**
D. Knoerr
President
Canadian Federation of Agriculture

# PLENARY SESSION I

# OPENING REMARKS

*Honorable John Wise*

The Canadian Agricultural Outlook Conference has been a tradition for 51 years — a very worthwhile tradition.

It's an opportunity for those of us involved in agriculture to trade information about both the short, and the longer-term prospects for the industry. The predictions you'll hear are not carved in stone. But they are based on the best information available, bearing in mind the considerable uncertainty about world markets.

This sort of information — uncertain though it may be — is needed to help all of us plan more effectively for the future.

Much of what you'll hear at this year's conference is not very good news. That won't surprise you. We all know that Canadian agriculture is enduring very tough circumstances — perhaps the most difficult circumstances in 50 years.

The seriousness of the situation is borne out by the projections of farm income, and the declines in farmers' equity.

We expect realized net farm income in 1985 to be about 14% below the 1984 level. Stabilization, crop insurance and drought assistance payments helped to some degree, but realized net farm income is still expected to be only about $3.7 billion this year.

Total agricultural production in Canada has apparently risen about 4% this year, after two poor years in 1983 and 1984.

Still, total farm cash receipts are expected to dip by about 3%. The second consecutive year of drought on the Prairies is the main factor. It has led to low farm stocks, reduced harvest volumes, lower grades and, therefore, a substantial reduction in grain receipts.

Events are not much more favourable in the livestock sector. Prices are lower and cattle herds continue to be liquidated.

Pork production has grown by about 3%.

There are fairly good reports for the poultry sector, where production was higher this year. Chicken production remained very strong, and turkey production likely will be up 4% this year.

Overall, commodity prices are expected to average about 5% lower in 1985 than in the previous year, while retail food prices will have risen about 3% since 1984, the smallest increase in 10 years.

Our agricultural exports for 1985 are forecast to decline to $9.1 billion giving Canada an agricultural trade surplus for the year of about $2.2 billion vhich is smaller than last year.

The picture is not much brighter for 1986, although I'm hopeful that it will mark at least the beginning of a recovery in the farm sector.

Realized net farm income for 1986 is expected to increase by about 8.6%, and further improvements are expected in the rest of the eighties.

We can expect farm cash receipts in the next five years to grow by an average annual rate of 3.4%. This suggests a gradual, but very welcome, strengthening of farm cash flow.

One of the brightest spots is the livestock sector. Lower feed costs will also provide stability to poultry, egg and milk prices next year.

Now let's look at the basis for these predictions.

High interest rates in the early 1980s — from which many producers are still struggling to recover — were the result of forces in the North American money markets well beyond the farmgate.

The low prices for most major farm commodities are a consequence of a global economic recession, export subsidy wars, and other countries' efforts to become more food self-sufficient. This has tremendous implications for Canada, since half of our farm cash receipts are derived from export sales.

The reality is that world demand for agricultural products has grown at a slower rate than supply.

Weather also worked against many of our farmers this year. Two to three consecutive years of poor harvests in the southern Prairies have extracted a heavy toll.

And to complicate the problem further, land values have declined. This is a key factor in the farm finance picture, so I'd like to elaborate.

The farmers in most difficulty tend to be the younger ones who entered farming after 1974, or those who expanded significantly during that period. From 1971 to 1980, the value of farm land

and buildings in 1981 dollars grew by $63 billion. But over the following five years, the value of these assets declined by $33 billion.

Consequently, there has been a substantial drop in farmers' equity, which creates a tremendous problem for producers who borrowed heavily against their land when values were high.

Difficult — very difficult — adjustments are occurring as a result. Governments have a responsibility to support the farm sector, and to help farmers make the necessary changes. Ultimately, however, farmers have to make their own management decisions.

This government has taken several measures to address the problems we know exist. But certainly more action is required, and will be forthcoming. I intend to talk about this in more detail in my closing remarks tomorrow.

When you look at the seriousness and complexity of the financial problems facing our agriculture industry, you can understand why considerable attention has been focussed on farm finances over the past year.

But there's a longer-term problem in agriculture — a problem we simply cannot ignore, and that's soil degradation.

The theme of this conference is Agricultural Resources for the Future. Future is the word to keep in mind.

Those of us involved in the agriculture industry must realize that nothing is more important to the future of the industry than conserving our most essential resource — our soil.

Just consider the consequences of neglect.

Degradation of Canada's agricultural land is estimated to cost the nation about $1 billion annually. Most of these costs directly affect farmers in the form of increased chemical costs, lower yields, and reduced international competitiveness. But there's also a cost to society in general. Salinization harms our waterways, and threatens our wildlife habitats.

So you see, soil degradation is a dollars and sense issue.

My department has developed an overall strategy for soil and water. All of you have been supplied with a paper produced by my officials on the state of agricultural soil and water resources in Canada. Mr. Bailey and Dr. Hill can tell you more about this later.

We cannot afford to ignore the problem. If we do, we'll find 50 years from now that our original topsoil has been entirely depleted. That's not much of a legacy for farmers to leave their children.

I am committed to continued research, and to more demonstration projects in joint participation with the provinces on the application of this research to on-farm situations.

The key is co-operation.

In fact, you could say the same thing about the other challenges we face in the agricultural industry.

It's no accident that agriculture was a priority issue at the First Ministers' Conference in Halifax two weeks ago. We have recognized the need for a co-ordinated, innovative national effort.

I can assure you the Prime Minister understands the importance of agriculture and, believe me, agricultural interests are well understood and represented around the Cabinet table. They know, and I know, that a great deal has been accomplished in a very short time, but that more action is required.

In our first Speech from the Throne, we made a commitment to revitalize the strength of our traditional resource industries, including agriculture. We have been meeting this commitment to Canada's farmers, and we're going to continue doing so.

In the summer of 1984 my Party introduced a 16-point program on agriculture, and we promised to deliver on those points during the mandate of our Government. After just over one year, we've already acted on most of the 16 points.

We introduced a $500 000 capital gains tax exemption on the sale of farm land.

We delivered on our promise to help farmers who were locked into high-interest FCC loans.

We doubled — as promised — the size of loans for advance payments under the Advance Payments for Crops Act.

We fulfilled our commitment to amend the Western Grain Stabilization Act in order to trigger — in time for spring seeding — the largest-ever payout from the fund.

And we moved forward — as promised — on a new voluntary national income stabilization program for the red meat sector.

In addition, we are providing special assistance in the order of close to $200 million to livestock and grain producers affected by the Prairie drought.

This Government has delivered with more legislation and actions on behalf of Canada's farmers than the previous Government even considered.

That doesn't mean we've done all we intend to do. Not at all.

Just as we have taken action in the past, we will continue to fulfill our responsibilities to Canada's farmers with more action in the future — the near future.

Tomorrow when I speak to you again, I'll be talking about my plans for further action — including significant new measures to address the urgent financial needs of the farm community, and amendments to the Bankruptcy Act to make special provisions for farmers.

Canadian agriculture has been travelling a rocky road in recent years, and it's going to be rocky for a while longer. But I do see us turning the corner towards better times within the next year or two. It will not be a dramatic, overnight turnaround. Our progress will be gradual.

But slowly, we're going to get there.

I give to you today my commitment to co–operate with the provinces, and with all sectors of the agriculture industry, along that road to better times.

# A POLICY PERSPECTIVE ON MANAGEMENT OF AGRICULTURAL SOILS IN THE DEVELOPING COUNTRIES AND THE UNITED STATES

*P. Crosson*

I am going to present to you today a perspective on problems of managing agricultural soils which I suspect many of you will find novel, and perhaps controversial. I am going to argue that there are indeed serious problems of soil management all around the world, but that, contrary to common belief, the principal problem is not deterioration of the long–term productivity of the land because of erosion. The more important problem, I will argue, is the immediate threat of sediment from eroded land to the productive capacity of reservoirs and irrigation systems, to water quality, to aquatic habitat, and to human life and property because of increased flooding.

I will also argue that this perspective on the threat of soil erosion implies a new perspective on policies for dealing with the threat. In some respects the policy problem may be easier, especially in developing countries, but in other respects it likely will be more difficult. Most important, however, if my perspective is correct, the policy problem is quite different from what it currently is perceived to be.

I believe this argument can be convincingly made for the United States. I am less familiar with the situation in Australia and Canada, and have little to say about those countries. The Europeans with whom I have discussed this set of issues do not believe that erosion is a serious threat in the major grain producing areas of western Europe, so I do not discuss that part of the world. One reads and hears that the threat is serious in the Soviet Union, but I am unaware of studies which provide a comprehensive, quantitative assessment of the nature and extent of the threat. The literature on soil management issues in the developing countries is relatively rich, although it too is anecdotal rather than systematically comprehensive.

In this discussion I deal with the situation in the developing countries and the United States. This is far from the complete picture, but it is a significant part of it. I am satisfied that the argument I make about these regions applies generally to other major agricultural areas as well, but I cannot prove it and I do not expect you to follow me that far. I will be satisfied if you find what I have to say about the developing countries and the U.S., if not totally persuasive, at least worthy of your serious consideration.

My focus is exclusively on soil erosion. Other forms of soil degradation, for example, salinity build–up with irrigation in arid and semi–arid areas also presents problems as does the advance of deserts in Sub–Saharan Africa and elsewhere. However, most food production in the world occurs in humid and semi–humid areas where erosion is the main threat to the soil.

I begin with the situation in the developing countries. The first thing to note is that there are no comprehensive surveys of soil erosion in these countries. Such estimates as we have were made by applying so–called sediment delivery ratios to estimates of sediment deposited at the mouths of major rivers, such as the Ganges in India and the Yellow in China. For a variety of technical reasons, these estimates are so crude that they must be regarded with great skepticism.

Despite the absence of reliable information, however, there can be no doubt that in many parts of the developing world erosion is greatly in excess of that attributable to natural causes. The observations of numerous experts recorded in a voluminous literature make this quite clear. There also can be little doubt that erosion in these areas has increased over the last 30 or 40 years, probably substantially so. This can be inferred by the amount of forest and pasture land cleared for crop production or by people in search of firewood and by the increasing numbers of animals grazing, and overgrazing, the land. Not surprisingly, the greatest amounts of erosion are found in the mountainous regions of Asia, Africa and Latin America.

From the standpoint of soil conservation policy, erosion per se is of no special interest. It's the damage it does that excites concern. Broadly speaking the damage is of two sorts. One is the loss of the productive capacity of the soil on eroded sites. Erosion washes away soil organic

matter and the supply of associated nutrients, weakens soil structure and reduces plant available water supply. I call this on-farm damages, or costs, of erosion.

The other sort of damage occurs when the soil leaves the eroded site, especially when it gets into water. It accelerates the siltation of reservoirs, clogs drainage ditches and irrigation canals, damages fish spawning areas, increases costs of clean-up before the water can be used for domestic and other non-agricultural purposes, requires more dredging to keep harbors and transportation channels clear, reduces recreational values of the water, and by reducing the capacity of river channels increases the frequency and extent of flooding. I call this off-farm damages, or costs, of erosion.

There are no estimates of the costs of the two kinds of erosion damage in the developing countries. Abundant anecdotal evidence shows that in many parts of these countries past erosion has seriously damaged the productivity of the land. A soon-to-be-completed study undertaken for the Scientific Committee on Problems of the Environment (SCOPE) by Gordon Wolman of Johns Hopkins University and an international team by experts, takes note of, but does not endorse, a recent comprehensive set of estimates of productivity loss in parts of Asia, Africa and Latin America by 2000 if present rates of erosion continue unchecked. The estimates are in a study sponsored by the FAO. With this exception, studies of erosion's effect on productivity in developing areas were done almost exclusively on small experimental plots where top soil was removed and the resulting crop yields compared with those obtained on other undisturbed plots. But the soil, climate and management conditions vary widely and often in unknown ways among the various studies, making it impossible to draw valid general conclusions about productivity effects.

Nor is it possible to generalize about the permanence of the productivity losses that have occurred or that will occur if current rates of erosion continue. This is a point of paramount importance. Losses that can be easily restored clearly are less threatening than those which are permanent. The evidence is clear that where the losses are primarily in soil nutrients, leaving soil water holding capacity unimpaired, then productivity usually can be restored simply by applying more fertilizer. To be sure this costs something, but so do measures to reduce erosion. In such cases it may well pay farmers and society generally to accept the erosion-induced loss of nutrients, replacing them with fertilizer.

Where the loss is of soil water holding capacity, however, the problem potentially is more serious because such losses usually are permanent, or so expensive to restore as to be permanent for practical purposes.

The lack of information about the extent and permanence of erosion-induced productivity losses in the developing world makes it impossible to draw persuasive general conclusions about the severity of the problem. Comprehensive information about off-farm erosion damages also is lacking, but the anecdotal data are much richer and point, in my judgment, to the conclusion that these damages are of major importance. Eric Eckholm in *Losing Ground*, a widely cited book published about 10 years ago, gives data about the accelerated siltation of reservoirs in Colombia, Taiwan, and the Philippines which indicate high costs. For Columbia, Eckholm estimates the costs may run in the billions of dollars over several decades if erosion is not checked. Reduced reservoir storage capacity and the resulting loss of electric power generating capacity is the main reason. For Taiwan he notes that the Shihmen reservoir was designed to have a useful life of 71 years, but in only 5 years in the 1960s it lost 45% of its capacity because of erosion following deforestation and cropping of steep slopes upstream in the watershed. In the Philippines erosion caused by logging in the Agno River watershed threatens to reduce the designed life of the Ambuklao reservoir by half. Researchers at the East-West Center in Hawaii report estimates that in Pakistan unexpectedly high siltation has reduced the expected life of the $600 million Mangla reservoir from 100 years or more to 57 years or less. The researchers cite similar experience in India, where rates of siltation in 5 major reservoirs far exceed the design amounts, threatening major reductions in the expected lives of these reservoirs. Those of you who have experience in benefit-cost analysis know how sensitive the results are to changes in the expected lives of projects. A hydroelectric project based on a reservoir with a life of 50 years may offer an excellent economic opportunity but turn into a costly lemon if reservoir life is cut to 25 years.

The economic losses of reservoir capacity are the best documented costs of off-farm erosion

damages in the developing countries, but they are by no means the only ones. Although estimates of costs are not available, the literature is full of references to damages resulting from clogging of drainage ditches and irrigation canals and loss of recreational values because of turbidity in streams, lakes, and reservoirs. Less certain is increased flooding because of the reduced capacity of river channels, but this is widely believed to be one of the consequences of erosion in the developing countries.

Since we lack comprehensive estimates of the two kinds of erosion costs in the developing countries I cannot demonstrate conclusively that the off-farm costs, high though they are, are higher than the on-farm costs of productivity loss. I suggest to you, however, that despite the absence of data, there is an argument for believing that the off-farm costs are in fact higher. The argument rests on what we know about the behavior of farmers all around the world in management of their resources. The evidence is overwhelming that farmers everywhere are knowledgeable about the physical and economic constraints they face and that, within these constraints, they seek to maximize the benefits they receive from the resources at their disposal. This generalization applies as well to illiterate peasant farmers in the African bush as to corn-soybean growers in Iowa and wheat farmers in the prairie region of Canada. This, of course, does not mean that all farmers have perfect knowledge or that they are all strict economic maximizers. It does mean that as a group they are well informed about their particular situations and that they are responsive to economic incentives and disincentives.

For all farmers in crop production, the land is a major economic asset. For many it is their single most valuable asset. Erosion which threatens the productivity of the land threatens a vital economic interest of the farmer. There is every reason to believe that where they recognize the threat they will act to avert it within the limits of resources available to them. To be sure the productivity effects of erosion often are so gradual that farmers do not recognize them until significant loss has occurred. And even when they are aware of the threat, their resources of knowledge and capital may be too limited to permit a completely effective response. But one need but witness the carefully tended terraces throughout hilly regions of the developing world to recognize that farmers can and do act to control erosion. The important point is that where erosion threatens productivity, self-interest gives them incentive to do this.

No such incentive exists to protect against off-farm damages. These damages are not a threat to the self-interest of the farmer whose land is the origin of the offending sediment. Those downstream from him suffer the damage and pay the cost. Typically it is quite uncertain which farmer is responsible for what damage, and in any case those damaged are too numerous and too scattered to organize for effective action against the guilty farmers.

This difference in incentives, I argue, is fundamental to thinking about the nature and significance of the two kinds of erosion damage, and not only in the developing countries. Farmers have strong incentive to control erosion damage to their land, no matter how imperfectly they may act on the incentive. They have no incentive to control off-farm damages. I submit to you that this difference in incentive makes a prima facie case for believing that off-farm costs in the developing countries are higher than on-farm costs, probably by a significant amount.

There is little doubt that this is true in the United States. Studies done only in the last year or two indicate that in the U.S. off-farm erosion costs are several times — perhaps an order of magnitude — higher than on-farm costs. This is quite contrary to the conventional wisdom in the U.S. which always has ranked soil productivity loss as the nation's number one erosion problem. How could this misperception have come about the persisted so long?

Hugh Hammond Bennett, the father of the soil conservation movement in the U.S., put soil erosion on the nation's agenda back in the 1930s. An advocate of soil conservation in the evangelical tradition, Bennett was an effective speaker and writer. He toured the country and recounted in graphic terms the damage of erosion to cropland in the Piedmont region of the southeast, in the deep south, the blackland prairies of Texas, the plains of Oklahoma and northward, and across the cornbelt from Missouri and Iowa to Illinois. Bennett used phrases such as "almost complete devastation" and "ruined for cultivation" to describe erosion effects in these regions; and he estimated that about half the nation's cropland was in a severely eroded or even worse state in the 1930s.

The fact is, however, that neither Bennett nor anyone else in the nation knew how much erosion was occurring in the 1930s, much less what its effects on soil productivity were. It now is clear, however, that Bennett overestimated either the extent or the permanence of the effects, or both. Crop yield data and observation indicate that throughout the regions Bennett described as severely damaged the productivity of the soil is high. High yields in these areas are not just a reflection of technological advance, although that has been significant. However improverished it may once have been, the soil itself throughout much of these areas now is rich.

It was not until 1977 that we had good estimates of the amount of erosion occurring annually in the U.S. And it was not until those data became available that reasonably comprehensive estimates could be made of the effects of erosion on the productivity of the nation's cropland. Four such studies now have been done: two by analysts at the U.S. Department of Agriculture, one by a group of soil scientists at the University of Minnesota, and one by me and colleagues at Resources for the Future. Although differing substantially in method, the four studies agree in showing that continuation of present levels of cropland erosion for 50 to 100 years would reduce per acre yields at the end of the period by no more than 5 to 10%. Continuation of the technological advance at a rate even one-fourth of that achieved in the last 40 years would far more than offset this effect. And there is no reason to expect technological advance to be that slow.

Using assumptions about future crop prices and other economic factors, I estimate present annualized costs of erosion-induced losses of soil productivity in the U.S. over the next 100 years at $500 million to $600 million. This is roughly 1% of current annual costs of crop production.

By contrast, a study recently published by the Conservation Foundation indicates that annual sediment related costs of erosion in the U.S. are $3 billion to $13 billion, or 5 to 20 times higher than my estimates of on-farm costs.

The Conservation Foundation estimates are subject to considerable error, as are my estimates of on-farm costs. Nevertheless, the difference between the two sets of estimates is so large as to point, in my judgment, to the conclusion that in the United States off-farm erosion costs are substantially higher than on-farm costs.

Soil conservation policy in the U.S. has always been driven by the perception that erosion damage to soil productivity was, and is, the major threat. The perception seems to be shared in other countries as well. In the not-yet-released SCOPE report I referred to earlier, attention is almost exclusively on the productivity problem in developing countries. Off-farm damages receive only cursory treatment.

If I am right that the main problem is off-farm damage then this perception on soil conservation policy is going to have to change if the problem is to be properly addressed. In one respect the needed change in the U.S. may be more profound than in the developing countries. Because of the preoccupation with productivity damage U.S. soil conservation policy has taken per acre rate of erosion as guides to where the problem is most severe. Since these rates are highest on cropland, most policy attention has been given to cropland erosion. The conservation reserve provisions written into various versions of the 1985 farm bill now under discussion in the Congress deal exclusively with cropland.

Research done by several of my colleagues at RFF indicates that concentrating erosion control policy on cropland will make only a modest improvement in the quality of the nation's waters. This is because erosion from rangeland and forestland, although low on a per acre basis, is high in total because there is so much of this land. Consequently, even stringent controls on cropland erosion would still leave massive amounts of sediment delivered to the nation's rivers, lakes, reservoirs and harbors.

Although similarly preoccupied with the productivity problem, discussion of erosion control policy in the developing countries is not fixed so strongly on cropland as in the U.S. because of the widely recognized contribution to erosion of deforestation and over-grazing. Consequently, proposals to deal with erosion in the developing countries include action on forest and rangeland as well as on cropland.

In another respect the needed change in perspective should affect policy in the developing countries and the U.S. about the same. In both areas the main thrust of policy is to reduce erosion on those sites where the perceived threat to productivity is greatest. This makes perfectly good sense where the objective is to protect against productivity loss. But makes very little sense where the objective is to reduce off-farm damage. Erosion which threatens productivity is only by accident the erosion which threatens

off–farm damage. On deep soils with favorable subsoils, such as those in western Iowa, high erosion may proceed for many years without a perceptible impact on productivity. Sediment damage downstream, however, may be very high. Alternatively, relatively low rates of erosion on shallow soils with unfavorable subsoils may seriously threaten productivity but generate no downstream damage.

The fact is, when the objective is to reduce off–farm damage controlling erosion may not be the most cost–effective policy at all. Remember that the point is not to reduce erosion per se but to reduce sediment damage to reservoirs, irrigation systems and so on. We can do this by controlling erosion only if we can correctly identify those places on the landscape which contribute the damaging sediment. It turns out that this is very difficult to do, and the difficulty increases with the size of the watershed. The processes of sediment transport are poorly understood. They involve climate, topography, soil type and pattern of land use, but our knowledge of the relations among these and how they jointly determine the rate of movement of sediment through the watershed is weak. Research indicates, however, that the sediment we observe in the water at the mouth of the watershed may have left its site of origin upstream years, even decades earlier. Moreover, we are quite unable to accurately identify that site, except perhaps in very small watersheds. There are two important consequences. One is that there may be little relationship between the sediment we observe doing damage downstream and the erosion we observe upstream in the watershed. The second is that even if there is a close temporal relationship between sediment and erosion we still would be quite uncertain where on the landscape to focus our erosion control efforts to get the maximum reduction in sediment delivered downstream.

The problem is further complicated by the tendency of streams to scour their channels whenever the sediment load delivered overland to the stream is diminished. Thus, if we succeed in reducing erosion on the landscape the stream will go to work on its banks and bed so that the reduction in sediment delivered downstream may be small.

For these reasons, the traditional policy of reducing erosion on the land may be quite inefficient in getting at off–farm damage, the main problem. This suggests that it may make sense to shift attention to finding ways of reducing the sediment delivered to places where it does damage. If they adopt this approach the developing countries may find it easier to deal with the problem of erosion damage than if they stay with the traditional approach. Erosion results from the farming operations of thousands, perhaps hundreds of thousands, of farm families spread over large geographical areas. Inducing or requiring these people to adopt less erosive practices requires an administrative apparatus capable of reaching into all the erosion generating nooks and crannies of the watershed and effectively conveying the message, backed by financial incentives or the threat of sanctions, that erosion should be reduced. The U.S. has had such an apparatus in place for 50 years and it has operated with only modest success. The financial and administrative resources available to developing countries for comparable efforts are far less.

In contrast, significant reductions in sediment delivered can be achieved by concentrating on the relatively few points in the watershed where sediment is carried into reservoirs, lakes or other water bodies where it is unwanted. This is achieved through the construction of various works, for example, check dams and holding ponds. This approach relies, if you will, on a technological fix. It avoids the difficult social engineering needed to induce or require farmers to adopt management practices which not only may be unfamiliar but also more costly to the farmer. It seems likely, therefore, that the administrative requirements and the political costs of reducing sediment delivered should be less than those of reducing erosion.

I don't want to be misunderstood about this. I am not saying that because off–farm damage is the main problem, and erosion control may not be a cost–effective way of dealing with it, we should therefore abandon erosion control. What I am suggesting is a shift in emphasis that would give relatively less attention to controlling erosion and relatively more to controlling damaging sediment. Erosion control must remain in the policy arsenal but it should absorb relatively less of the resources devoted to dealing with erosion problems. If that sounds paradoxical it is because of the traditional fixation on productivity loss as the main problem.

Let me say something about the implications of this perspective for Canada. As one of the world's leading exporters of grain Canada has a

major interest in agricultural performance in the developing countries, because they are customers, and in the U.S., because it is a competitor. It appears to me that erosion in the developing countries may affect agricultural performance enough to touch the Canadian interest, but that in the U.S. it will not.

Let me explain. I doubt that erosion damage to soil productivity will significantly limit the ability of the developing countries to expand agricultural output. Throughout Asia and Latin America per capita output has increased for several decades despite rapid population growth and increasing erosion. Per capita output in Africa has fallen, but the evidence is strong that the main reason is long neglect of, even outright discrimination against, agriculture, not soil erosion. The continued success in Asia and Latin America, and eventual success in Africa, if it is achieved, will depend primarily on what these countries do to develop a continuing stream of new agricultural technologies and an economic environment giving farmers incentive to adopt them, rather than on what they do to reduce the erosion threat to productivity.

But off-farm damages of erosion in the developing countries may be high enough to retard progress in agriculture. This may or may not be to Canada's advantage. Agriculture is such a significant source of income in developing countries that if agriculture lags income lags, and if income lags demand for imported grain may lag also. Thus the prospect of significant off-farm erosion damage to agriculture in developing countries does not necessarily imply higher export opportunities for Canada. It may be just the reverse.

I think it very doubtful that erosion in the U.S. will weaken its competitive position in world agricultural markets. I cited above a rough estimate that continuation of present rates of erosion for 50 to 100 years would contribute only about 1% to present costs of crop production. Over that period agricultural performance in the U.S., as in the developing countries, will depend primarily on technical development and the economic environment, not on erosion's effects on soil productivity. Off-farm costs in the U.S., although high, are borne primarily by recreational users of water, consumers of hydropower, and the general public, not agriculture. Canada should not expect that its competitive position relative to the U.S. will be affected one way or the other by what the U.S. does about its erosion problem.

To sum up, soil erosion presents a serious problem in many countries around the world. But the problem is not only, and in my judgment not even primarily, the threat to soil productivity. The problem of off-farm damage is both more immediate and, so it seems to me, more threatening. It deserves more attention from those engaged in soil and water conservation policy than it so far has received. Until that happens, if the main thrust of policy continues to be on control of erosion, not sediment, we likely will make little progress in dealing with the main problem.

# IMPLICATIONS OF PRESENT SITUATION AND OUTLOOK FOR AGRICULTURAL NATURAL RESOURCES IN CANADA

*D.A. Rennie*

## ABSTRACT

The farmers of Canada face an unprecedented opportunity through the adoption of new technology to contribute to the economic well-being of the country, as well as to continue to play a major role in providing food for a hungry world; but significant changes in agri-food policies are required, primarily to encourage and facilitate adoption of economically viable farming systems compatible with the soils and climate in specific regions of the country, and to ensure that products moving into the export market can do so in a dependable manner and at competitive prices.

The discussion first centers on a number of comparative yardsticks, which unequivocably underscore the seriousness of soil degradation in most but not all regions of the country. For example, estimated annual soil degradation costs exceed 100% on the prairies and approximately 50% elsewhere, of the costs of carrying charges on long-term farmland liabilities. When expressed on a per hectare basis, these costs are relatively constant across the country, averaging $20–$25 per hectare. All data shows that soil degradation is clearly the most serious in the prairie region, where it was equivalent to 80% or more of the net income in that region in 1983. Today, the producer is shouldering the full cost of soil degradation, but tomorrow these costs will be borne by the consumer.

On the basis of what is known today, degraded soils in the more humid regions of the country can be reclaimed relatively rapidly and at comparatively low costs. In the semi-arid regions of the country, degradation may, and has in some cases, resulted in irreparable damage. A number of constraints which have negated the adoption of soil conserving practices in the country are discussed. These lead to a discussion of policy imperatives one is to remove surplus land from production, thus allowing that which remains, to produce at a maximum. This approach is clearly intolerable. An alternative is to proceed with an aggressive marketing policy, which may include for short periods, forced sales at any price. It is suggested that this approach could be achieved through deepening and enlarging such programs as the Western Grain Stabilization Program and crop insurance in western Canada.

Soil conservation research across this country has been shortchanged, partly because it has been convenient to categorize, and, accordingly, support research on a commodity basis only. Thus, a final and important policy imperative is to re-examine the structure of agricultural research, which justifiably should be directed towards dismantling the commodity orientation.

Dr. Crosson's presentation, together with Agriculture Canada's background paper, have clearly documented soil deterioration as a serious global and national problem. My task this morning is not to unnecessarily belabor the scope and extent of soil degradation in this country, but rather to review causative factors where such are known, and comment, to the extent that wisdom will allow, on policy options which may not only encourage the arrest of further degradation, but reverse the downward trend that has been so consistent and evident for some 20 years now (Rennie, 1973).

## BACKGROUND

During the past year, I have been fortunate to work with a team of senior soil scientists across Canada who have prepared documented cases of the seriousness of soil degradation in their respective provinces or regions. This study, carried out under the auspices of the Science Council of Canada, is close to completion. The interpretive soil degradation data that I am going to refer to in just a moment has been compiled from these studies (Miller, 1985; Rennie 1985). There are numerous approaches that I might have taken to leave with you the highlights of this study; but in my opinion, the impact of several soil degradation processes can perhaps best be understood by economists in particular where they are translated into $ units. This provides a definitive value which can be compared with a wide range of other yardsticks used to measure the welfare of the agricultural industry.

Due to time limitations today, I am not going to make any specific references to the soil degradation processes listed in Tables 1 and 2. A monogram on these processes is scheduled to be published by the Science Council early in 1986. The estimated cost of soil degradation in the Atlantic region and in the six provinces to the west of that region deviate somewhat but not significantly from those provided in Agriculture Canada's background paper to this conference. Some comparative yardsticks of the impact of the 46, 1,011, 250, and 23 million dollar per year annual costs for B.C., the prairies, central Canada and the Atlantic region clearly underscore the observation that the problem of soil degradation is probably significantly more serious than even the "gloom and doom" environment targeted by practically all the speakers at the early November meeting of the Canadian Bankers Association in Saskatoon; that conference after probing in depth the magnitude of the FARM CREDIT CRISES event went so far as to suggest that a basic and fundamental shift had occurred in the credit needs of agriculture, and this, together with rapidly plummeting asset values, required a multi-dimensional solution that farm credit institutions had little hope of solving.

A quick scan at the data given in Table 3 shows that soil degradation costs expressed as a percentage of carrying charges on long term agricultural or farmland liabilities exceed 100% on the prairies and approximately 50% of the carrying costs of these liabilities elsewhere in the country. I have heard no one challenge the "near crisis situation" phrase used frequently today to describe farm credit. Clearly a similar phrase aptly describes soil degradation.

It is interesting to note that when expressed on a $ . ha$^{-1}$ of farmland basis, soil degradation costs are relatively constant across this country, ranging from a low of $15 in the Atlantic region to a high of $25 in central Canada. The impact, however, of soil degradation is clearly most serious in the prairie region where it is equivalent to approximately 80% of the net income of that region in 1983. To further clarify the relative seriousness of soil degradation, when expressed as a percentage of the cost of agricultural chemicals (pesticides and fertilizers) in central and eastern Canada, it is equivalent to approximately half, but in the prairies and B.C. in excess of 100%. It *is* worthy also to note that today the producer is shouldering the full costs of soil degradation, a burden that he is not going to be able to carry for many more years into the future. Thus, the move sideways of soil conservation issues from the domain of the scientist to that of the politician and public are more than warranted and the selection of this issue as the theme for the 1985 Outlook Conference is most appropriate.

## AN UNEXPLAINED DILEMMA

It is appropriate for this conference to consider the question – Why did the degradation of soils in this country go undetected by the public and the politicians for so long? Perhaps a simple answer is that very few of us look at what we don't want to see. Having said that, in western Canada the practice of summer fallowing has been known for many years to result in accelerated erosion losses, organic matter degradation and spread of salinity (Rennie, 1973). Yet that practice was so deeply imbedded in the minds of everyone as the key to successful farming under semi-arid conditions that it is only in recent years that public concerns have been voiced. Similarily, row crops such as corn and potatoes in central and eastern Canada respectively have played a less dramatic, yet quite serious role in accelerating degradation.

Considerable credit must be given to increasing public awareness, and hence providing an environment for the development of strategy options, to three recent publications. The first was a technical report prepared by PFRA which brought together for the first time under one cover a wide range of documented studies on the quality of the prairie region soil resources (PFRA, 1983). Two subsequent publications have contributed in a very major way to public understanding of soil degradation throughout this country. "Soil at Risk", a special report prepared by the Senate Committee on Agriculture, Fisheries and Forestry (H.O. Sparrow, 1984) has resulted in a major attitudinal change on the issue of soil degradation. Fairbairne (1984), commissioned by the Agricultural Institute of Canada, prepared a popular rendition of soil degradation in Canada titled "Will the Bounty End?". His sobering chronicle of the status of soil quality led to the conclusion that the wealth of agriculture and the cheap food enjoyed by Canadian consumers have been built on lost soil.

Not respecting the much increased public awareness of soil degradation in Canada, there is no indication that the very low level of funding allocated to the studies of possible solutions has changed (Rennie, 1985). In 1984 less than 1% of the total agricultural research funding was allocated to soil conservation and less than 9% to the soils area in general, and so today there are major areas of uncertainty in remedial practices that might be economically undertaken by the agricultural industry to arrest further soil degradation. It is imperative that the very low level of professional man years allocated to soil degradation in this country (Table 4) be sharply increased, even if this has to be done at the expense of other agricultural sectors.

## REMEDIAL CONSERVATION PRACTICES

There is sufficient evidence at the present time in the prairie region to conclude that the popular crop fallow cropping system is primarily responsible for the rapid soil degradation that has been so extensively documented. Research reported from Saskatchewan approximately 15 years ago clearly confirmed that farming practices incompatible with the soils and environment were the major reason for the rapid decline in soil quality (Rennie, 1973). There is sufficient hard data available at the present time to support the statement that a new, water efficient cropping system holds the key not only to reversing the continued downward trend in soil quality, but to the reclamation of soils which have deteriorated even below a critical level. This cropping system is presently under evaluation, but it appears that the present low level of efficiency of using available water, one cm producing 23 to 25 kg grain $ha^{-1}$ can be economically increased by a factor of 100%. Thus while mismanagement has been fingerprinted as the main reason for soil degradation on the once highly fertile prairie soils, the economic viability of the new cropping system requires extensive field confirmation, and a wide range of components of the new cropping system need extensive supportive basic and field research.

The remedial practices are equally clear in central and eastern Canada. The causative factors of erosion are quite simple and well known, namely, the escalation of row cropping. However, satisfactory economic alternatives are not, in the opinion of most farmers, available under the present economic situation. Unfortunately, it would appear that a resurgence of the livestock industry in the east which would directly ensure a return to longer crop rotations, including forage crops, is not on the horizon.

## Food for thought!

One point which has surfaced out of the Science Council study, which is worthy of brief comment on at this point, is that under the more humid conditions prevailing in central Canada and the Atlantic region, degraded soils can be reclaimed relatively rapidly, provided intensive cropping with cereal grains and/or integrated livestock operations are economically viable. The dramatic improvement in soil quality throughout much of Europe and England attests conclusively to this observation. Unfortunately, this is definitely not true in the semi-arid regions of western Canada. Thus where extensive salinization has occurred, the land must be removed from cultivation for periods as long as half a century or more and may not even then be usable for annual crop production. Similarly, rebuilding the N fertility level of severely organic matter depleted prairie soils is a long and costly practice and farmers must now face the bitter fact that they are going to be dependent on costly synthetic fertilizer N for many years into the future even though they change their cropping system. Thus the economic impact of soil degradation in semi-arid regions of the country can be termed far more serious than in the more humid regions, and in my opinion, such areas must, therefore, receive top priority in gaining access to public assistance where such has been demonstrated to assist in preventing further soil degradation.

## CONSTRAINTS TO THE ADOPTION OF SOIL CONSERVING FARMING SYSTEMS

In western Canada soil conserving cropping systems are identical to high water efficient cropping systems. In eastern Canada soil conserving cropping systems primarily require the inclusion in the cropping system of a forage crop, and in extreme cases, the exclusion of row crops. As I am not familiar with constraints, except in a very general sense, that prevent a more widespread use of soil conserving cropping systems in more

humid regions of the country, my remaining comments under this title will relate to a brief *outline of constraints preventing farmer adoption* of soil conserving farming systems in the prairie region.

## Cereal grain quotas

Wheat Board quotas used extensively for the dual purpose of ensuring orderly marketing and controlling production have encouraged much greater use of summerfallow than would otherwise have occurred (McCartney, 1984). Quotas to be used for orderly marketing should be based on seeded acreage only, not on cultivated acreage. A very slight adjustment was made two years ago in this direction, but the adjustment has been insignificant in altering the perception the farmers have of quotas as a means of controlling production. Thus, in years of high stocks in farm storage, fallow acreages are increased.

## Farming misconceptions

There are a wide range of misconceptions associated with recropping land in Saskatchewan in particular. Not the least of these is that it is "hard on the land" (the reverse in reality is true), or that seeding should be delayed until the rain starts and that "chemical agriculture" is bad. Not respecting such viewpoints, there are a growing number of documented cases of management errors that have led to serious crop losses, particularly in the drier years which have prevailed during the summers of 1984 and 1985. These have resulted in: inflated costs of chemfallow, a practice known to be much more efficient in conserving water; yield decreases following the application of nitrogen on moderately or severely sulfur deficient soils; seeding winter wheat too deeply or where standing stubble is not available to hold the snow; deep plowing Solonetzic soils; fertilizing without the guidance of soil tests; a wide range of other improper management practices; a dearth of forward planning where management decisions are made days or months after they should have been.

## Transportation constraints

It is absolutely essential that potential export sales or customers not be lost as a result of our inability to move the product to coastal ports. Changes in the Crow rate have led to major new investments by the transportation industry which in time will at least in part overcome this constraint. The recent blocking of the Welland Canal highlights the need for improved transportation dependability in the east as well.

## Crop insurance

The jointly sponsored federal–provincial crop insurance programs in Canada differ from province to province. In general they are designed to compensate for losses due to natural causes, and benefits are based on actuarial principles. In Saskatchewan, at the present time, crop insurance discriminates against farmers who recrop as coverage is reduced for specific crops in accord with historical data. This historical data, however, reflects outdated management practices. Thus, to encourage farmers to recrop using water efficient cropping practices, significant policy shifts are required. Similarly, the insurance program discriminates against farmers whose claims are due to factors over which they had no control as they are faced with lower coverages the following year. Such constraints are not conducive towards encouraging farmers to reduce summerfallow acreages.

## Technology transfer

Reference was made above to a selected number of management errors which have sharply curtailed the profitability of recropping. As farmers change to a more complex high cost cropping system they will need a much accelerated technology transfer system to support them.

## Research and development

This is a serious constraint in western Canada largely brought about by the almost complete demise of production oriented research during the '70's. Canada at the present time has significantly fewer research scientists in agriculture than almost every other food exporting country in the world. Until recently, the agricultural industry has not suffered too seriously from lack of research support, primarily because of the highly fertile soil resources that were so prevalent over much of this country. However, these are no longer with us, and from here on out, there is no way we can directly transfer much of the agricultural research done elsewhere to Canadian conditions. There is a further reason

for urgency in stepping up agricultural research in that competition for export markets is clearly going to become much fiercer in the near future. It cannot be overemphasized that research not only makes possible higher levels of production, but in particular increases efficiency on a per unit basis of this production.

## POLICY IMPERATIVES

The majority of the hard data available to date would suggest that under both semi–arid conditions such as those typical of western Canada, and the more humid conditions prevailing elsewhere where economic conditions enable farmers to produce at or near optimum levels, conservation farming practices require no public support. Thus in Saskatchewan it has been estimated that even partial adoption of the new water efficient, soil conserving cropping system would quickly lead to yield increases in the vicinity of 60% or more. Saskatchewan farmers accordingly face an unprecedented opportunity to adopt new technology to contribute to the economic well–being of the province as well as to continue to play a major role in providing food for a hungry world. International trade, however, particularly in cereal grains, is increasingly competitve and it is anticipated that this trend will continue. This not only reflects rapid growth in production in developing countries, but forced export of agricultural products from the developing countries in order to meet trade imbalances. The situation is further complicated by increasing protectionism, and it is in this international marketplace that Saskatchewan farmers find themselves in the position where deterioration of their soil resources has sharply skewed, to the disadvantage of themselves, the ratio of operating cost to returns. Is there a policy imperative that might prove effective in such an environment? *One approach would be to remove surplus land from production and thus allow that which is left to produce at a maximum*. The high costs associated with this approach are highly unpalatable from the public viewpoint and perhaps unacceptable from the standpoint from the farmer owners directly affected.

An alternative extreme would be *to develop an aggressive marketing policy including for short periods FORCED SALES AT ANY PRICE*. The burden of this approach would logically be shared between the agricultural industry and senior governments and this could be achieved through the deepening and enlarging of such programs as the Western Grain Stabilization Program.

Other policy strategies again directed towards the solution of the soil deterioration in western Canada include a much stepped up technology transfer facility to assist farmers in successfully surviving the transfer from a simplistic crop fallow to a farming system that will enable them to more than double the efficiency with which available water is used. Microcomputer technology is today at a stage where such a policy could be implemented tomorrow.

Associated with transfer of technology to the farmgate is the need to sharply increase research support including the establishment of the much talked about federally funded Soil and Water Research Institute at Saskatoon. Consideration must also be given to revising crop insurance programs presently in effect; crop insurance must assist in shouldering more of the risk associated with the adoption of new soil conserving cropping systems. One approach would be to remove premium penalties where circumstances beyond the control of the farmer are responsible for crop failures.

The removal of drought prone soils such as the coarse textured soils from annual crop production and policies to encourage farmers to bank slightly and moderately saline and seriously eroded soils could pay major dividends in that such soils are in many years a serious drain on crop insurance reserves.

It is essential if this country is going to move towards a more competitive role in international food markets that the government play a much stronger and perhaps leading role in reversing protectionist trends which inhibit the free movement of agricultural produce both interprovincially and internationally. The time has long since passed that action which protects agricultural production in areas of high cost and leads to undue competition with agricultural production in areas of low cost can be economically tolerated.

Encouragement of farmers to adopt soil conserving cropping systems must go hand in hand with an improved program of agricultural credit.

Reference was made earlier to the need to improve and make more effective programs such as the Western Grain Stabilization Program. This can quite readily be deepened and made

more sensitive to subregional variations in production levels. This program must not, however, become a vehicle whereby the treasury of one province competes with the treasury of another to influence the location of agricultural production.

A further point I would like to make relates to what we perhaps should not do. There are those amongst us who would like to see more detail and more precision on the scope and extent of saline soils or eroded soils. These same people strongly support the use of scarce research dollars to firm up the estimates now available on the costs of soil degradation. To my mind, these are delaying tactics. It matters little whether the estimated cost of soil degradation in this country is a billion dollars, two billion dollars or half a billion dollars. What is clearly known today is that soil degradation has imposed an unacceptable cost on the producer. Tomorrow the consumer is going to have to shoulder a major portion of this and the imperative today is not to fine tune these cost estimates, but to get on with the job of reclaiming the soils of this country.

And finally, soil conservation research has been shortchanged because we have found it convenient to categorize research on a commodity basis only. Thus the final policy imperative is to re-examine the structure of agricultural research, and if the commodity orientation has to go, so be it. Our job is to ensure that the agricultural industry receives the kind of technology support it so urgently requires. Our present research structure has been found wanting, and I say the time has come for a change.

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TABLE 1 ECONOMIC COSTS OF SOIL DEGRADATION, WESTERN CANADA[a] ($ x 10)

| | B.C. | Alta. | Sask. | Manitoba | Total |
|---|---|---|---|---|---|
| Erosion | 10.2 | 200.0 | 220 | 9.8 | 440.0 |
| Organic Matter Loss | 11.5 | 144.0 | 170 | – | 325.5 |
| Acidification | 4.6 | 4.8 | 50 | – | 59.4 |
| Salinity | – | 80.4 | 120 | 12.0 | 212.4 |
| Drainage | 7.1 | – | – | – | 7.1 |
| Compaction | 12.5 | – | – | – | 12.5 |
| Total | 45.9 | 429.2 | 560 | 21.8 | 1056.9 |

[a] Rennie, D.A., 1985

TABLE 2 ECONOMIC COSTS OF SOIL DEGRADATION, CENTRAL AND EASTERN CANADA[a] ($ x 10)

| | Ontario | Quebec | Atlantic | Total |
|---|---|---|---|---|
| Erosion | 68 | 10 | 11 | 89 |
| Compaction | 21 | 100 | 6 | 127 |
| Acidification | 1 | 4 | 11 | 12 |
| | 90 | 114 | 23 | 227 |

[a] Miller, M.H., 1985

TABLE 3 THE IMPACT OF SOIL DEGRADATION SOME COMPARATIVE YARDSTICKS[a]

| | Annual soil degradation costs expressed as | | | | |
|---|---|---|---|---|---|
| Region | $per ha farmland | % of net income | % of op. expenses | % of Ag. chemicals | % of carrying charges on longterm liabilities[b] |
| British Columbia | 21.9 | 33.6 | 6.7 | 130 | 44.5 |
| Prairies | 19.2 | 79.0 | 16.7 | 106 | 122.5 |
| Central | 25.5 | 18.1 | 4.6 | 48.2 | 43.7 |
| Atlantic | 15.3 | 17.3 | 5.0 | 44.9 | 66.2 |

[a] Handbook of Selected Agric Statistics, 1984, Min. of S&S, Canada, 1984
[b] 12% of longterm liabilities

TABLE 4 PROFESSIONAL MAN YEARS ALLOCATED TO SOIL DEGRADATION RESEARCH[a]

| | Western Canada | Canada |
|---|---|---|
| Soil Quality | 5.8 | 13.5 |
| Erosion | 0.5 | 5.2 |
| Salinity | 3.2 | 3.2 |
| Drainage | 0.4 | 1.4 |
| Total | 9.9 | 23.3 |
| Total soils | 60.8 | 198.8 |
| Agriculture | 673.4 | 2031.3 |

[a] Laing, 1985

# STRATEGIC PRIORITIES FOR AGRICULTURAL NATURAL RESOURCE USE

*R.C. Bailey*

## INTRODUCTION

Current farming practices and the policy framework which supports them are causing soil and water degradation problems in many agricultural regions of the country. These problems are manifest on the farm by declining and more variable crop yields, reduced crop quality and higher input requirements in areas where degradation occurs. The effects of soil erosion alone cost Canadian farmers over $600 million each year. This amount is approximately equivalent to what Canadian farmers paid for pesticides in 1983. The total on-farm cost of all forms of degradation combined probably exceeds $1 billion annually. It is threatening the sector's long term profitability and competitiveness.

Soil degradation also imposes significant off-farm costs through its effects on water quality. In Central and Eastern Canada alone that the off-farm costs of soil erosion are approximately $100 million annually.

Agricultural activities can also impose off-farm costs in the absence of soil degradation. Some environmental groups are concerned about how agricultural land-use practices, especially the drainage of wetland areas, are eliminating wildlife habitats.

The purpose of this paper is to outline briefly Agriculture Canada's proposals for addressing these problems. I will first outline some principles; next, I will suggest what needs to be done; then, I will suggest who should do what.

## THE STRATEGY

Agriculture Canada's strategy for soil and water resource sustainability is built on the following four principles:

### Prevention

First, public and private activities should place relatively more emphasis on finding and implementing methods of *preventing* agricultural soil and water degradation from occurring, rather than focussing on treating symptoms.

### A supportive policy environment

Second, our concerns in government about soil degradation should be reflected not only in specific soil conservation programs but also in our commodity development strategies and related policies.

### Geographic target areas

Third, we must focus our conservation programs in those specific geographic areas where degradation currently poses the greatest threats to agricultural productivity and in areas where the risk of potential problems is highest. Key areas are the lower Fraser River Valley, the Peace River district, Central and Southern Alberta, Saskatchewan, Southern Ontario, the St. Lawrence Lowlands of Quebec, and the Maritime potato growing areas.

### Enhanced information flows

Fourth, we see enormous potential to help resolve many of agriculture's resource sustainability problems by improving the quality and timely transmission of objective information between players. We envisage not only improved information flows *to* farmers, but also an enhanced communications network *between all players* in the agricultural system.

In short, we envisage a policy environment which incorporates more fully our concerns about soil and water resource deterioration into the activities we already undertake in support of the development of the agricultural sector. Environmental and economic objectives need to be merged.

## THE CHALLENGES

In order to assist farmers to control soil and water degradation, we perceive that governments and the private sector need to improve performance in four major areas.

## Improved production systems

While much environmentally sound production technology has been developed and more will need to be developed the required effort to adapt this knowledge to local conditions and to incorporate it into on–farm production systems has not been attained. More work is required in the design of such economically viable production systems, adapted to local environments, which prevent the occurrence of unacceptable levels of soil degradation. This leads to the second priority.

## Improved communication and coordination

One major reason why producers are not adopting sustainable production practices more quickly is because they lack access to site–specific information about those systems which will work economically and those which will not. There are small but critical gaps between research, extension and the farm which must be filled with site specific, highly applied technology adaption projects. Scientists, extension agents and farmers in target areas across the country must get together to fine–tune the technology for solving resource degradation problems. From these projects feedback loops from the farmer back to the research bench and the communication of relevant ideas between farmers, will improve.

## Improved policy signals

We must also create an agricultural policy environment which actually encourages the adoption of sustainable, non–degrading soil and water management practices.

Existing support policies and programs, such as stabilization, crop insurance, production quotas, municipal land taxation and others need to be reviewed to determine whether they promote or discourage the adoption of soil conserving production systems. Adjustments, where possible, can then be contemplated for those which inadvertently discourage conservation, to neutralize their negative effects. We must also examine ways to redirect funds, currently used to treat the off–farm effects of soil degradation, for example, expenditures on clearing sediments from ditches and waterways, to encourage on–farm practices which prevent the problems from occurring in the first place. In order words, we must try to build in more rewards to farmers who adopt sustainable management practices that reflect genuine savings to society.

## Private compensation mechanisms

We are aware of cases where the interests of non–farm groups are negatively affected by a farmer's economically rational land–use decisions. I recall a recent article in the "Western Producer" which illustrates this problem. A group of farmers were apparently in conflict with an environmental group over proposals to drain a wetland meadow. The landowners wanted the meadow drained to permit harvesting of the excellent hay crop. The environmental group wanted to preserve the natural ecology to ensure the retention of nesting habitat for waterfowl. Improved private market procedures need to be developed whereby non–farm groups can compensate producers for making land–use decisions favourable to that non–farm group. The proposed North American Waterfowl Plan recently released by the Canadian and U.S. Governments provides an opportunity for new approaches such as this to be tried out.

# WHO DOES WHAT

Let me now provide our interpretation of what each player must do to meet these challenges.

## The agricultural producer

The active participation of the farming community is, of course, the key to success in controlling soil degradation problems in the agricultural industry. Most farmers in Canada are landowners and, consequently, have the privilege and responsibility for deciding how that land is used. It is clear that most farmers want to be part of the solution and, fortunately, some already are.

First and foremost, many more producers need to become more aware, with the assistance of governments and agribusiness, of how modern agricultural production practices affect soil and water quality. By implication, such awareness includes informing themselves about the processes and causes of degradation. It also includes the monitoring of soil and water quality on their own farms.

Second, producers must try to improve their interactions amongst themselves with respect to sharing information on production practices. The good work of soil and crop improvement associations, local conservation groups and other farm organizations must be encouraged and accelerated. While government can provide supplemental assistance in this area, the concerted input of farmers is key to success.

Third, producers must assist government to improve its services by providing feedback on research needs, and on the effectiveness of applied research results and technology transfer programs. This feedback is critical to the refinement of sustainable production systems and it implies, of course, that governments must listen and react to this feedback.

## Agri–business

Some agricultural supply companies have done an enormous amount of work to promote so–called "conservation farming". As other presentations at this conference will, no doubt, confirm, conservation farming is rapidly becoming big business. But more can and must be done.

Control of degradation will depend heavily on all input manufacturers and suppliers building the objective of "environmental sustainability" into the design and testing of new products. It will depend on them using product marketing strategies which emphasize that soil conservation pays.

To supplement existing extension services, farm management consulting firms and the farm media should continue to take advantage of opportunities to incorporate environmental concerns into the advice and information they provide their farmer clients.

## Governments

Provincial departments of agriculture have been increasingly active in improving soil and water management practices. Most provinces fund their own soil conservation programs and a number have entered into development agreements with Agriculture Canada which have soil conservation components. The role of the provinces in promoting economically and environmentally sustainable agricultural development is critical. The provinces work directly with the farmer. They also have regulatory authority over land and natural resource use. These factors put them in a very powerful and influential position.

Agriculture Canada, has also become increasingly active in soil and water related work. The department has completed a number of studies chronicling the extent and severity of soil degradation across the country. It has initiated on–farm and off–farm soil conservation programs in cooperation with many provincial governments. It has expanded its research efforts and it has designed a departmental strategy for soil and water resources which forms the basis of this paper.

In suggesting a partitioning of responsibilities between levels of governments, let us first examine those which must be *shared*.

The Feds and the provinces must review their agricultural support policies to determine how, if at all, these policies influence producer decisions to adopt sustainable or non–sustainable production practices. Of primary interest are those I've already mentioned: production quotas, crop insurance, stabilization, farm credit, and taxation policy. Where shown to promote resource degradation, adjustments to neutralize these negative effects must be made, where feasible. Adjustments to provide positive signals to producers must also be sought. In addition, ways of implementing the concept of "cross–compliance", where only producers who do not degrade their land are eligible for government support programs, must be examined more closely. In short, both levels of government must find ways to create a development policy environment which discourage avoidable resource degradation and encourages the adoption of commercially viable, sustainable management practices.

Next, and of critical importance, we must work together to better coordinate our respective activities. Where we have appropriate consultative mechanisms in place, we must use them. When such mechanisms do not exist or are inappropriate, new or improved systems must be created. We must extend these coordinating links to non–government organizations and to agribusiness. The tasks at hand are too important to risk working at cross purposes to each other, or to risk critical issues falling between the cracks of jurisdictional responsibility as they sometimes have done in the past. We would propose to lean heavily on the federal–provincial agricultural development

agreements as a prime coordinating mechanism, for they can integrate development with environmental concerns, and they can be tailored to meet specific objectives or constraints in specific areas. They can also set the development objectives for both levels of government upon which priority setting on all development programs, including those for soil and water issues, should be based.

Third, both levels of government should actively seek to encourage the resolution of disputes over agricultural land and water resources between producers and environmentalists, using private sector consultative and trading mechanisms whenever possible.

Having dealt with shared responsibilities, let me now suggest prime *responsibilities for the provincial governments*.

First, provinces have full responsibility for their natural resources, including responsibilities for ensuring adequate supplies of good quality agricultural land and for implementing capital works related to land-use, such as land clearing, irrigation and drainage.

Second, provinces have a key role to play in improving information flows related to soil and water management between governments, agri-business and the farmer. We perceive a real need for an enriched extension service, with expertise in soil and water conservation, targetted to areas where degradation problems are particularly severe. Extension agents need to work more closely with research scientists to assist in determining research needs and priorities.

Finally, let me now outline our view of *Agriculture Canada's responsibilities* in a national soil and water strategy, in addition to those I have already described which it would share with the provinces.

First, Agriculture Canada would increase its activities in the design, development and assessment of environmentally and economically sustainable production systems. By this I mean that we are proposing to adjust our research and development priority-setting mechanisms to better integrate soil conservation objectives with crop and livestock development activities.

Second, the department would contribute to improved information coordination by investigating the feasibility of developing an agricultural soil and water resource information system. Such a system could go a long way to organizing and making accessible information on the effects of agricultural production on the natural resource base. It would also work to enhance public awareness of soil degradation problems and solutions.

Third, Agriculture Canada would increase its activities in soil degradation monitoring. One aspect of such monitoring is to chart our progress in controlling soil and water degradation. Another aspect is to develop monitoring systems for farmers to use themselves on their own farms.

As the first step in getting this strategy implemented, the Minister has proposed to the provinces that a federal/provincial task force be formed to report to Canadian Ministers of Agriculture within the year on a national action plan for agricultural resource sustainability and enhancement which addresses these issues that I have raised. The task force members will be consulting with the private sector on their needs during this time.

## CONCLUSION

In summary, the agri-food industry is now at a cross-road with respect to its treatment of soil and water resources. Much of the industry employs non-sustainable production practices. The resulting degradation currently costs the industry close to $1 billion each year. Because these problems are increasing in intensity, it is incumbent upon all players in the system to take the goal of reducing soil degradation very seriously.

The sector needs an action plan or a strategy which focusses on prevention, targeting, information flows and integrated policies. To make this strategy work, sustainable production systems need to be developed and implemented; information flows and coordination of activities need to be improved; better economic signals need to be put in place which encourage farmers to adopt sustainable production methods; and, compensation mechanisms between non-farm and agricultural interests need to be put in place.

Implementing this strategy is a formidable, but a feasible and essential task that has begun at this Conference today.

## OVERHEAD 1 SOIL DEGRADATION

Cost Agriculture approximately $1 billion per year
Off-Farm damages of approximately $100 million per year
Threaten growth, competitiveness and stability of agriculture

## OVERHEAD 2 PROPOSED STRATEGY

Emphasize prevention
Supportive policy environment
Geographic target areas
Enhanced information flows

## OVERHEAD 3 WHAT NEEDS TO BE DONE

**1. Improved Production Systems**
Environmentally sustainable
Economically viable
Adapted to specific environments
Requires applied research and on-farm testing

**2. Better Communications and Coordination**
Producers need to know which systems work
Fill gaps between research and extension
Improve 2-way information flows between all players

**3. Improved Policy Signals**
Examine existing support policies
Do they encourage or discourage soil conservation?
Make adjustments where feasible

**4. Private Compensation mechanisms**
Improve procedures required to resolve land use conflicts

## OVERHEAD 4 WHO DOES WHAT

**1. Farmers**

Awareness of how crop management affects soil and water quality

Share available conservation information

Better feedback to government on research and development needs

**2. Agri-Business**

Incorporate "Environmental Sustainability" objectives

Consulting firms advise clients on conservation

Farm media keep farmers informed

**3. Governments Shared Responsibilities**

Build conservation objectives into support policies

Improve intergovernmental coordination

Provinces

Land supply policies

Capital improvements

Enhanced extension services

Federal

Increased research and development

Soil and water information system

Public awareness

Monitoring

# TOWARDS A LONG TERM STRATEGY

*H.M. Hill*

## INTRODUCTION

We have had the opportunity this morning to consider presentations from very eminent soil conservationists and researchers. They have defined for us their vision and assessment of the major soil and water issues that confront us.

Dr. Rennie has pointed out the particular severity of land degradation under the climatic constraints of Prairie agriculture.

Rod Bailey has outlined an Agriculture Canada strategy for sustainable agriculture development. I will discuss some of these considerations in a prairie context.

The long-term strategies necessary to resolve these issues must be multidimensional. Each player requires strategies and operational choices. *Choices* – that are designed to meet the basic challenge. *Choices* – that are available to all farmers, industry, society and government – who might have an interest in our soil resource. I would like to use these next few minutes to elaborate briefly on the complexity of these choices; the nature in which they are made and the danger in using a simplified "top down" approach to address our resource issues.

## SCOPE OF ISSUES AND THE BASIC CHALLENGE

Our response to these issues will be based on a fundamental objective. I would state that objective as follows:

> "To ensure the best use of our soil and water resources, recognizing the limitations of these basic resources and the need to sustain them in the long term".

This, of course, is motherhood and few would disagree with such a statement of concern or challenge. However, not far from motherhood, there is substantially less unanimity in the perception of the scope and severity of the issues. Accordingly, the appropriate response to the issues is much less well defined.

As an example, at one extreme, some acknowledge soil conservation to be a valid issue – but *only* between the farmer and his land. For others, land use as close as possible to the undisturbed environment is desirable. In between, we have the majority of farmers who reside on the land, till it and who must decide just what a "best use" is.

There are, three kinds of priorities (or choices) – the choices of the people closest to the resource – the farmers; the choices of all the others who serve the farmer in some way including industry, teachers, advisors, researchers and surveyors; and the choices of those who govern how the soil is used through legislation and government policies.

First, I would like to make some general observations that apply to all three categories.

Firstly, *farm operations are driven by the basic resources of soil, water, climate, crops and people.* Our approach to soil and water management must, therefore, be directed from the bottom up and determined according to the capabilities of the resource *as well as* the need for profitable income.

Secondly, *we must understand the resource thoroughly and appreciate the requirements of all users.*

Thirdly, formation of appropriate policies and priorities for soil and water demands *a sound knowledge of where we have been and a strong sense of where we want to be.*

I will come back to these three general observations later.

The development of "choices" is complex for those who assist the farmer or those who develop policies or legislate land use.

In this context, I must observe that agriculture policy has not, at times, reflected the long-term resource capabilities. In addition, policies are often umbrella in nature while each farm resource base is unique. The need for farm profitability and the need for long-term resource sustainability must come together. *The challenge* is to bring these needs together for the nation, the region, and, above all for each farm.

This brings me to the *choices* available to farmers. As I have just noted – these are extremely important and have a major impact on agricultural production. The farmer at one level

must decide upon the enterprise mix he employs – i.e. mixed cattle–grain operation, straight grain, grain–oilseed and so on. At a subsequent level, he must determine the management input strategies that suit him best, i.e. degree of mechanization, productive inputs such as fertilizer, levels of cash flow required etc. For each farm, there will be a unique soil and water conservation strategy. The soundness of the strategy depends on the integration of a *"best fit"* enterprise together with a set of *"best fit"* management practices for that enterprise (Figure 1).

## FARM OPERATIONS ARE DRIVEN BY THE BASIC RESOURCES

### "The back 40" – a highly variable situation

Let us consider the inherent uniqueness of each farm, its impact on the flexibility of farmers to choose and the needs that must be met if choices are to be enhanced. My observations reflect the Prairie region context. However, the general concerns are, I am sure, equally applicable in other regions of Canada.

We all are aware of the variability in soil productivity and water supply availability across the Prairie region. This variability is depicted on a macro scale. Examples include CLI for soil and precipitation or runoff maps for water. The implications of this variability for each farm are often underestimated or poorly appreciated (Figure 2).

Water as a major constraint occurs as either an overabundance or a scarcity. On–farm practices such as summerfallowing have historically been developed to make dryland farming possible. However, at both extremes, solutions often involve regional water works for irrigation or drainage. While such solutions can be quite dramatic, their applicability is ultimately limited in geographic extent.

The constraint of soils is, of course, intertwined with climate and precipitation. However, at any given site generally, soils must be accepted as they are. On any given farm, they can pose a whole range of limitations upon enterprise and/or management options. For instance, there are lands that should not and cannot be cultivated. Also, the difference in farm practice between a farm in the Black soil zone of Manitoba to one in the most arid portions of the Brown soil zone in the Palliser Triangle demonstrates the water availability constraint.

The farm in Manitoba is in a relatively flexible position. Cropping enterprises can include continuous cropping with a wide range of crops and rotations. Further, risk can be substantially lower.

On the other extreme, the farms in the Brown soil zone are perpetually hampered by low rainfalls that reduce selection of crops and ability to extend rotations. Climate in this area increases stress upon the land while the farmer's ability and flexibility to adjust is diminished.

These limitations are understood. Farmers attempt to limit effects of limited water availability through a variety of drought buffering measures including irrigation when water is available. However, for most, limited water availability and, therefore, limited cropping choices are a fact of life.

### Determination of integrated "best fit" farm systems

The determination of a "best fit" cropping rotation and management system is a farm level on–site decision. Generalizations are useful in promoting concepts but fraught with difficulties when dealing with a farmer's specific conditions (Figure 3). For instance, in the Brown soil zone forages might be a problem in rotation but absolutely essential to the solution of a salinity problem. Thus the farmer must identify not only the best cropping system but the practical considerations that might detract from that production. As another example, field crops on sandy soils in Manitoba might be acceptable with appropriate erosion controls. In southeastern Alberta this same soil resource might demand that the land be developed for grazing or forage production.

### Water infrastructure development

For many farmers removal of water constraints involve their neighbours and possibly a whole region. Solutions require collective action and involvement – whether it be for an efficient and rational drainage system or for an optimum irrigation supply. Because water is so scarce in large regions of the Prairies it is not surprising

that a developmental attitude pervades western thought on water. Further, it is self-evident that water supply potential must be determined on a regional basis.

## Rural land use also reflects multiple use realities

Farms are increasingly managed to reflect multiple use objectives. Many rural lands offer potential for multiple use and benefits to society. Such uses include wildlife habitat, recreation and forestry or woodlots. The nature of the use may vary markedly from upland game and small animals in arid regions to waterfowl nesting in more humid areas. However, such multiple use potential is real and is promoted, not only by specific wildlife agencies, but in many cases by the farmers themselves.

## Economic infrastructures

As we go from the climate-soil portion of our ecosystem to the people side we enter the world of economics. I will start this section off with a quote:

> "Another conclusion from our survey of the use of land through 7000 years, where economic conditions have changed for better or for worse more rapidly than climate, is that land, after all, is not an economic commodity. It is an integral part of the nation even as its people are and require protection by the individual owner and by the nation as well."[1]

Lowdermilk wrote that in 1953 after investigating the degree to which soil management brought about the demise of civilizations, especially in the semi-arid or arid regions of Africa and Asia Minor. One of the important questions that must be addressed is that of efficiency of various cropping systems. Are specialized monoculture type operations "most efficient"? Can and should we be moving towards more diversified systems? McGill[2] in a recent paper observes that not only is diversified production necessary for soil conserving systems but essential for economically stable agriculture. He further submits that we should emphasize efforts to find or create markets for our unique agriculture based on the diversity of our resources. Looking at things from a soil and water viewpoint our own experience suggests that this approach has some merit.

However, diversification implies a high degree of difficult adjustment at the farm level. Also, adjustments at the government and industry level may be very difficult. Dr. Rennie's paper emphasizes the linkage – any attempts at farm centered initiatives for soil conservation will be ultimately limited unless they recognize the impact of markets.

If diversification and extended cropping is the only road to effective soil and water management, it will take a great deal of effort to adjust while maintaining financially viable farms. It will also take a long time to accomplish. In this case, it will be farmer attitude and developed markets that will determine if effective implementation of soil conservation will become a reality.

## WE MUST UNDERSTAND THE RESOURCE THOROUGHLY AND APPRECIATE THE REQUIREMENTS OF ALL USERS

## Awareness

The need for awareness has been well promoted and is well appreciated. Such awareness must be ensured at all levels – from a sensitive public; inquisitive researchers; determined politicians to well advised farmers. We as society must understand that farmers may not be able to pay all the costs of effective soil conservation. Farmers on the other hand must understand that each farm unit is a unique biophysical-human ecosystem. The challenges to each operator are great and for some will require a distinctly new approach to farming.

Awareness programs must be sensitive to the farmers *choices*. For instance, people agree that summerfallowing is a practice detrimental to soil conservation. A farmer in the brown soil zone hears and understand the message. He looks at his choices:

- *snow trapping* – yes, the farmer says but not always effective enough to do away with summerfallow;
- *continuous cropping* – O.K. but risks may be too high to justify input costs; and
- *chem fallow* – the farmer may be tentatively trying it but costs of chemicals are high.

The farmer realizes there are very limited *choices* that would allow elimination of summerfallow. However, if the farmer is continually bombarded with insensitive propaganda, the net result may be negative instead of positive.

## Intellectual infrastructure

Spanning the gap between society and the operator requires an intellectual infrastructure that identifies the resource problems, defines their nature and develops appropriate solutions. This infrastructure includes systems of inventory, research, development, extension and monitoring. The end product must be "best fit" management, integrating "best fit" soil and water conservation, and the "best fit" commodity mix. Our efforts must be client driven since our greatest intellectual resource are the farmers who till each acre according to its needs. In the Prairie region, the value of the intellectual infrastructure is becoming better defined *and* supported by farmers. There are some who would go so far as to promote commodity checkoffs as one means of ensuring appropriate research resourcing.

# WELL, WHERE HAVE WE BEEN AND WHERE DO WE WANT TO BE?

## Where have we been?

Certainly we appreciate the physical realities of the 1930's. And, in fact, it must be admitted that massive programs were undertaken at that time – many of which benefit us to this day.

In more recent times, we have heard more about the physical issues of land degradation. Certainly that data is worth considering.

Economic assessments suggest the insidious nature of its impact. However, some might venture that other structural economic problems far outweigh the significance of this issue. Can we afford to ignore the impact of land quality on productivity sustainability or growth?

McGill[3] warns that we *do so* only at our own peril. For instance, by comparing fertilizer input trends versus cereal production he concludes that the quality of the soil resource has significantly reduced expected yield increases (Figure 4). In a further extrapolation to an economic base, he notes that lowered soil quality has contributed substantially to the increased gap between expenditures on inputs and value of outputs for field crops (Figure 5).

Again I would ask – do we really have the sound knowledge of where we have been – particularly in the more recent past?

## Where do we want to be? Where should each farm be in the future?

As we come to the bottom line of our *choices*, we again must emphasize the ultimate objective of a farm properly managed – according to the "needs of each acre" as stated by Hugh Hammond Bennett. In summary what is required to accomplish this?

### Awareness

While many farmers know their dilemma, further knowledge is necessary for them to tackle these difficult problems.

### Intellectual infrastructure

The intellectual infrastructure must be supported, and encouraged to evolve as findings by farmers, researchers, industry or advisors bring new approaches that affect the work of each other.

### Tools

Each farmer must acquire a detailed understanding of the intricacies of production system options available as well as the specific farm problems and the available remedial measures. Further, the farmer must understand how such tools such as forage cropping for seep control, shelterbelts, stubble management "best fit" into an integrated system of management.

### Economic setting

The biggest challenge is to incorporate good soil conserving and water management practices with a viable farm economy and viable rural lifestyle. Many things influence this including markets and government policy. We cannot afford systems that focus only on profitability and ignore stability and sustainability.

1 Lowdermilk, W.C. 1938/39. Conquest of the Land Through Seven Thousand Years. U.S. Department of Agriculture, Soil Conservation Service. Bulletin 99.

2 McGill, W. 1985. Soil Conservation Requires Integrated Agricultural Systems. Second Century Opportunities for Agriculture Conference. Edmonton, Alberta.

3 Ibid.

FIGURE 1 FACTORS AFFECTING CHOICES AVAILABLE TO FARMERS

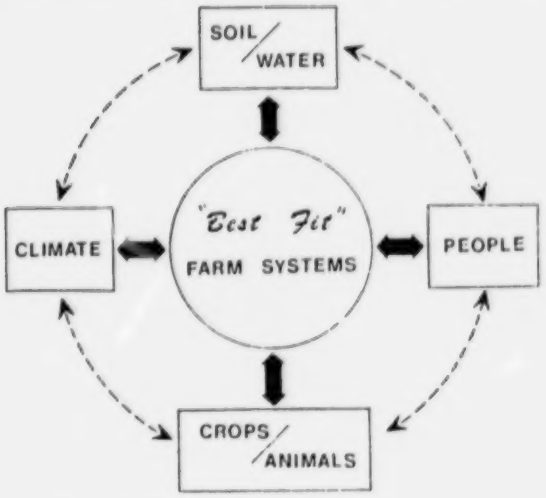
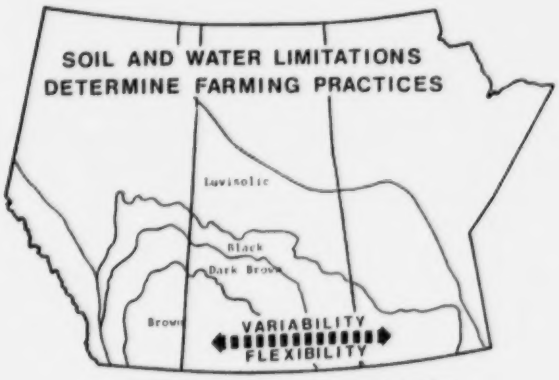



FIGURE 2 VARIABILITY OF PRAIRIE SOIL RESOURCE BASE




VARIABILITY OF PRAIRIE SOIL RESOURCE BASE

FIGURE 3 RANGE OF FARMER'S CHOICES

FIGURE 4 INDEX OF QUANTITY OF N, $P_2O_5$, $K_2O$ USED AND OF TONNES OF BARLEY AND WHEAT PRODUCED BETWEEN 1966 AND 1984. (FROM: McGILL, 1985)

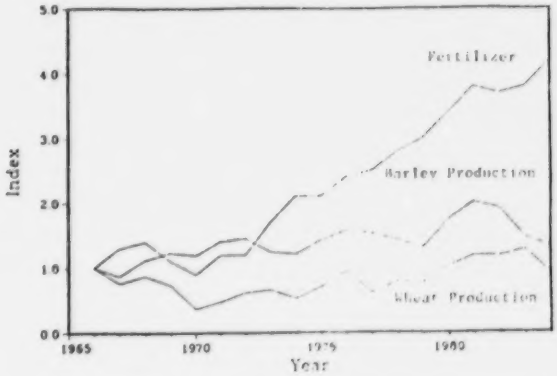
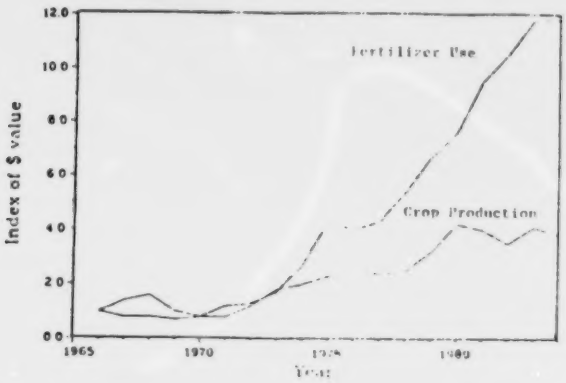


**FIGURE 5 TRENDS IN TOTAL COST FOR ALBERTA OF FERTILIZERS USED ON FARMS AND VALUE OF TOTAL CROP PRODUCTION BETWEEN 1966 AND 1984. (FROM:McGILL, 1985)**



# PLENARY SESSION II

# SHORT–TERM ECONOMIC OUTLOOK FOR CANADA

*Leo de Bever*

While preparing for this talk, it occurred to me that the range of economic issues seems to be very limited. In 1965, when I was a student in Europe, we were greatly concerned about the adjustment to free trade within the context of the common market, the pros and cons of a value added tax, and how to restore the financial health of the agricultural sector. Twenty years later, the language and the country are different, but the same issues are still very much in vogue.

I am sure that farm issues will be dealt with quite adequately at this conference. VAT is unlikely to move beyond the discussion stage over the next two years. Even free trade is unlikely to be of major consequence over that period, despite its current prominent position in the press.

It is much more opportune to go from the philosophical to the pedestrian. In the short time available today, I will try to paint the headlines on five issues: economic growth, inflation, unemployment, interest rates, and exchange rates. I will close with a few observations on free trade.

As you are probably aware, observers of the U.S. economy are currently debating whether the economic upswing that started in 1982 is about to come to an end. I realize that many people in this room will find that a pretty esoteric topic, given that there has been precious little recovery in the agricultural sector. So if you'll bear with me, I am going to have to deal with how the other 90% lives.

The U.S. outlook underlying the Canadian forecast calls for modest but positive economic growth. Recent GNP measures exaggerate the true strength of the U.S. economy, because of timing of government purchases, excessive inventory buildup, the likelihood that investment growth will taper off, and declining consumer confidence.

After a very respectable 1983 (3.7%) and a strong 1984 (6.8%), real growth for 1985 and 1986 is expected to average 2.5%. The last few years prove once more that when you infuse an extra $200 billion of government money into the economy, growth does occur. Unfortunately, that leaves the problem of what to do for an encore when the deficits start to become difficult to justify and service.

It does appear that in resolving that dilemma over the next few years, an outright recession can be avoided. Growth will be modest but is not expected to be negative. None of the signs of an ending business cycle is apparent: inventories have not been built up to dangerous levels, inflation is not increasing, labour shortages are not yet significant, and interest rates are under very little pressure to rise significantly for a sustained period of time.

Canadian growth in 1985 has, to most people, been surprisingly strong. A 4.25% increase seems likely in 1985, with a slowdown to the 3% range in 1986. The focus of economic growth is shifting from exports to domestic sources. Consumer expenditures will not repeat the 5% growth record of 1985, but will still be quite respectable. Investment shows signs of recovering from very low levels at a rate of 6% per year. Housing starts in the 160 000 range are quite feasible.

Is that good? Our performance is generally far inferior to that of Japan. Yes, we are growing faster than the U.S. at this stage, but we have a lot of lost time to make up: our 1982 recession was far worse, and the recovery far slower. For example, when one indexes manufacturing output for the U.S. and Canada to 1972=100, two things become apparent: (1) with the exception of the Canadian federal spending spree of the mid–seventies, Canadian and U.S. performance was about the same up to 1982; (2) recovery has been far more limited in Canada since 1982.

The same picture emerges in GNP or various sectoral indicators. Canada has traditionally enjoyed economic growth 1% higher than the U.S., in part to make up for the faster rate of expansion in the labour force. The explanation for the slow growth of recent years can be found to a large extent in the discrepancy between productivity and wage escalation. It is true that rates of change in wages have declined, but wage

levels are still not enough to allow profitable employment of the remaining unemployed. I strongly believe that if we can somehow keep productivity and wages in balance, the traditional pattern of faster growth in Canada than in the U.S. can be restored. The plain truth is that we are currently underachieving.

We expect continuation of past trends in the shift of output and employment from manufacturing to services. Large companies will continue to reduce employment as productivity growth exceeds expansion of demand. It has been going on for years, and should not be a cause for concern, except to the extent that it leads to technological unemployment. Evidence available so far suggests that this is happening no more frequently than it has in the past.

Concern has been expressed that the service sector will be unable to absorb the workers leaving primary and secondary sectors of the economy. Past experience has shown that this is not the case. The transfer of jobs from primary and secondary to the service sector over the last 5 years has been dramatic. Demand is slowly but surely shifting away from goods-producing sectors. The labour intensity of services makes it quite feasible to equal or exceed past rates of job creation in services.

The past few years have seen a dramatic decline in the rate of inflation from 10% in the late seventies and 12% in the early eighties to 4% in 1985 and 1986. Will this low inflation environment last? We tend to think it will. The world faces large commodity surpluses in food as well as non-food commodities. North America faces more global competition in commodity as well as manufacturing markets, severely limiting opportunities to raise prices. Employers have had little difficulty justifying lower wage increases. Finally, it does not appear that the decline in the value of the two dollars against most currencies outside of North America will translate into renewed inflation: import margins have been very healthy, and are likely to absorb most of the devaluation.

The major exception to the low commodity price picture has been oil. Whereas relative prices for most commodities are at about the same level as in 1973, oil is roughly four times as expensive. Even with very modest sensitivity of demand to price, it stood to reason that reliance on oil would decline. We now use only half as much oil as we did in 1973 to produce a given quantity of real GNP. We expect another 20% drop between now and the end of the century. It would be wrong to argue that the current weakness in oil prices would significantly alter that trend. We will continue to shift away from oil in space heating. It will continue to be profitable to conserve through insulation.

The major disappointment of the last few years has been the slow decline in the rate of unemployment. A comparison of U.S. and Canadian experience shows a less dramatic run-up in U.S. unemployment and a more decisive drop after 1982. The major explanation for this can be found in the responsiveness of Canadian wages to soft labour markets. When one juxtaposes the rate of employment growth and the rate of wage increase, two things are clear: except for 1982, employment growth has always been positive. Secondly, slower wage growth has tended to lag behind slower employment growth by two years. For example: at the height of the 1982 recession, with job losses running at 300 000 per year, wage increases were still running at a 10% annual rate.

We do not see our recent unemployment experience as a sign of structural weakness. It is primarily an issue of unit labour cost increases outstripping productivity growth. Based on demographic and migration patterns, it is quite possible that labour shortages will develop in various sectors in the early nineties. If productivity growth turns out to be as fast or faster than we project, we expect only transitory impact on employment growth.

The combination of slow increases in producer prices, relatively high labour cost, and modest demand growth has kept profits to a smaller-than-average fraction of nominal GNP. We expect that this will continue to be the case for some time. This has certain consequences for investment. In conjunction with high real interest rates, low profit margins limit sources of investment funds. Despite the pickup in investment activity of 6% for each of the following two years, the 1981 peak in investment will not be surpassed until 1988 or beyond.

The high real interest rates of the eighties are not expected to decline overnight. However, it is clear that from a long-term perspective, the current situation is an anomaly. High rates are justified with references to(1) the potential for "crowding out" of the U.S. federal deficit,(2) the potential for monetization of future deficits(3), the need to finance the large U.S. trade deficit. The counter-arguments are that(1) real interest

rates already embody a more than adequate risk premium for inflation,(2) external competition will keep inflation low,(3) there would be a significant benefit for U.S. trade, economic growth, and the federal deficit, if interest rates were to decline a notch or two.

Since we don't subscribe to the two-handed economist theory, let's be clear that we side with those who see rates coming down. It may be true that high U.S. government deficits pose dangers to inflation and crowding out, but one also has to recognize that high levels of debt outstanding at high interest rates contribute to very high deficits. Similarly, if interest rates were not so high, the U.S. dollar would be lower, making imports less attractive. This would provide more room for growth, higher tax revenues, lower government deficits, and less of a need to import capital. The only problem with this argument is lingering fear of high inflation. There is ample room for real interest rates to come down if our inflation outlook is correct. Nominal interest rates should therefore stay at or below 10% for the next two years, with only occasional reversals tied to fluctuations in economic growth.

The sensitivity of the U.S. deficit to interest rates can be illustrated by looking at the debt and the deficit in round numbers at 10% debt service cost vs. 8%. With a very modest assumption of 10 billion in extra tax yield from stronger growth due to lower interest rates, the deficit drops by nearly one half after 5 years under the low-interest scenario.

The size of the Canadian federal deficit may be a concern in itself, but it is of little consequence to the interest rate discussion. Canada's federal deficit is about the size of the estimation error on the U.S. deficit. In the context of the North American credit market, the variance in our federal deficit is negligible.

Aside from interest rates, the Canadian dollar has been a major concern over the past year. Based on the fundamentals that determine the exchange rate, the worst would appear to be behind us. Canadian inflation is close to U.S. inflation. Our current account may weaken somewhat, but not enough to make a great deal of difference. Interest rate differentials with the U.S. are expected to stay small and relatively stable. The devaluation of the U.S. dollar in Europe should marginally increase the Canadian dollar's value in U.S. funds. The only true negatives should be transitory: the so-called 'banking crisis' appears to be over. Year-end transactions of U.S. companies and Canadian individuals are this year depressing the dollar. We nevertheless believe that a modest rebound will occur next year, although it is unlikely to result in a value of more than $ U.S. 0.75.

I want to conclude with some remarks on the current discussions about free trade. Free trade is unlikely to have a dramatic impact soon. The basic notion behind considering free trade is that the current allocation of production and employment could be better. It is therefore unrealistic to expect that free trade will make all sectors and all provinces better off.

The U.S. protectionist debate tends to focus on the large bilateral trade balances in goods that now exist with various countries including Canada. We should not be bashful in pointing out to the Americans that our $20 billion surplus in goods is off-set to a large degree by $14 billion in interest and dividend payments that find their way into the U.S. If this still seems like a large balance, it must be seen within the context of a cumulative current account deficit, with the U.S., of close to $40 billion since the mid-seventies. In other words: our trade has been far more balanced than would appear at first sight.

Free trade must be judged against its potential to improve the efficient flow of goods and services in North America, and to increase our standard of living in the process. It offers a large number of suppliers operating out of the U.S. a small new opportunity. A smaller number of Canadian companies get better access to a very large market. In certain sectors, we are at least a match for the Americans. We may have to give some ground in certain areas. But it strikes me that there is also ample room for cross-border ventures between fairly evenly-matched partners.

It is quite clear that free trade will have to result in rationalization and elimination of internal inefficiencies. All of this will impose transitional adjustment problems. One can argue that these problems could be potentially severe. The evidence cannot really be assessed definitively without making assumptions about Canadian capacity to exploit opportunities opened up by free trade.

The biggest problem we face may turn out to be the way we perceive ourselves. If we assume at the outset that a Canadian company can never come out ahead in a commercial struggle in a North American free market, our chances of being successful may not be large. In view of the many Canadian companies that do compete effectively already, a more positive attitude towards Canadian potential under free trade would seem to be both necessary and consistent with past experience.

OVERHEAD 1 ECONOMIC GROWTH – U.S.A.

- GNP to increase 2.5% in 1985 and 1986
- Recession will be avoided
- Continuation of unspectacular growth most likely

OVERHEAD 2 ECONOMIC GROWTH – CANADA

- GNP to increase 4.25% in 1985, 3% in 1986
- Total growth since 1980 has been weaker than in U.S.
- Slow adjustment in wages has kept down growth, employment
- Strong possibility that Canada will grow faster than the U.S. in 1986 and beyond

OVERHEAD 3 SHIFTS IN THE COMPOSITION OF ECONOMIC ACTIVITY

- Continued relative shift of output and employment from manufacturing to services
- Large companies will continue to reduce employment, as productivity growth exceeds expansion of demand

OVERHEAD 4 EMPLOYMENT AND OUTPUT BY INDUSTRY SECTOR

| | Employment | | | G.D.P. | | |
|---|---|---|---|---|---|---|
| | 1980 | 1985 | Difference | 1980 | 1985 | Difference |
| | (000's) | | | (71$B) | | |
| Forestry | 75 | 51 | -24 | 0.8 | 0.8 | 0 |
| Mining | 176 | 154 | -22 | 3.5 | 3.5 | 0 |
| Manufacturing | 1 919 | 1 704 | -215 | 25.8 | 27.2 | +1.4 |
| Construction | 406 | 368 | -38 | 7.1 | 6.5 | -0.6 |
| Utilities | 114 | 118 | +4 | 3.8 | 4.6 | +0.8 |
| Transport | 489 | 447 | -42 | 7.6 | 8.4 | +0.8 |
| Storage | 14 | 14 | 0 | 0.2 | 0.2 | 0 |
| Communication | 220 | 222 | +2 | 4.7 | 5.5 | +0.8 |
| Trade | 1 526 | 1 633 | +107 | 15.0 | 17.2 | +2.2 |
| Services | 2 594 | 3 068 | +474 | 22.8 | 25.7 | +2.9 |
| Government | 637 | 656 | +19 | 8.0 | 8.7 | +0.7 |
| **Total** | 8 670 | 9 000 | +330 | 117.8 | 129.0 | +11.8 |

## OVERHEAD 5 INFLATION LIKELY TO REMAIN LOW

- Large commodity supply surpluses, energy as well as non–energy
- North American markets face more intense global competition in all markets
- Opportunities to increase wages, prices are limited
- Exchange rate effects on inflation not large

## OVERHEAD 6 UNEMPLOYMENT

- Primarily driven by labour cost in relation to productivity
- Higher productivity growth will only pose transitory problems for total employment
- By 1990s, labour shortages may develop, based on current demographics and migration patterns

## OVERHEAD 7 INVESTMENT AND PROFITS

- Profit margins to remain low
- Reduced reliance on external funds for investment due to high cost
- Investment activity to remain below 1981 peak for the next three years

## OVERHEAD 8 WHY INTEREST RATES COULD INCREASE

- U.S. deficit "crowds out" private demand for credit
- Fear of higher U.S. inflation through monetization of future deficits, dropping U.S. dollar
- Foreign capital can only be attracted if U.S. interest rates remain high

## OVERHEAD 9 WHY INTEREST RATES COULD DROP

- Real interest rates already reflect a more than adequate "risk premium" for inflation
- Inflation likely to remain low because of strong external competition
- Lower interest rates and devaluation of dollar would increase economic growth and lower the U.S. federal deficit

## OVERHEAD 10 THE $2 TRILLION QUESTION

| | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|
| | | | $ billions | | |
| **Interest rate average 10%** | | | | | |
| Debt | 1 820 | 2 000 | 2 220 | 2 442 | 2 686 |
| Deficit | 200 | 200 | 200 | 200 | 200 |
| Servicing | 180 | 200 | 222 | 244 | 268 |
| **Interest rate average 8% – phased in 2 years** | | | ($10 billion tax yield) | | |
| Debt | 1 820 | 2 000 | 2 180 | 2 320 | 2 450 |
| Deficit | 200 | 170 | 140 | 130 | 120 |
| Servicing | 180 | 180 | 174 | 186 | 196 |

## OVERHEAD 11 WHAT MAKES THE CANADIAN DOLLAR MOVE

- Relative Inflation Performance
- Current Account Balance
- Interest Rate Differentials
- Devaluation of the U.S. dollar in Europe and Japan
- "Confidence" in the Banking System
- Year-end transactions of U.S. companies and Canadian individuals

## OVERHEAD 12 FREE TRADE WITH THE U.S.

- Unlikely to have dramatic impact soon
- Cannot have positive effects for all sectors
- Should be accompanied by removal of internal inefficiencies
- Biggest obstacle in the way we perceive ourselves

## OVERHEAD 13 RHETORIC ON TRADE SURPLUS WITH CANADA

- Focuses on trade in goods
- Ignores the very large deficit in services

FIGURE 1. MANUFACTURING (1981 = 100)

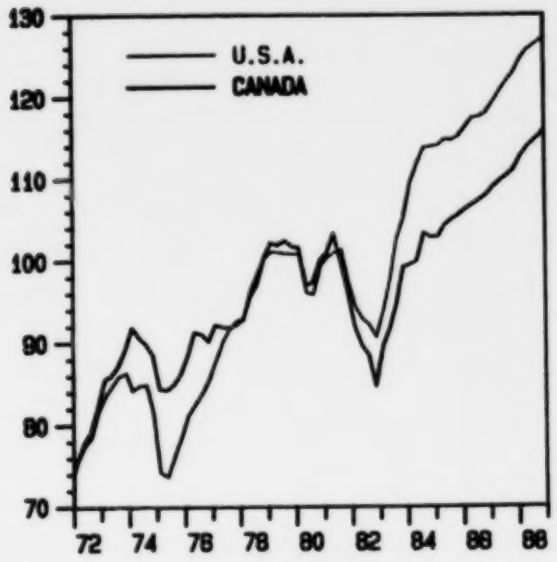



FIGURE 2. MANUFACTURING % OF OUTPUT AND EMPLOYMENT

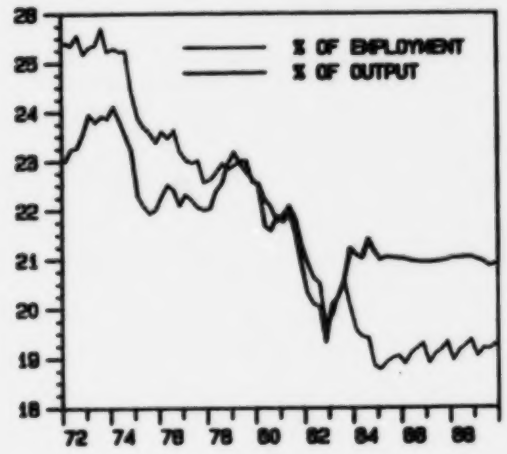



FIGURE 3. C.P.I. (% CHANGE)

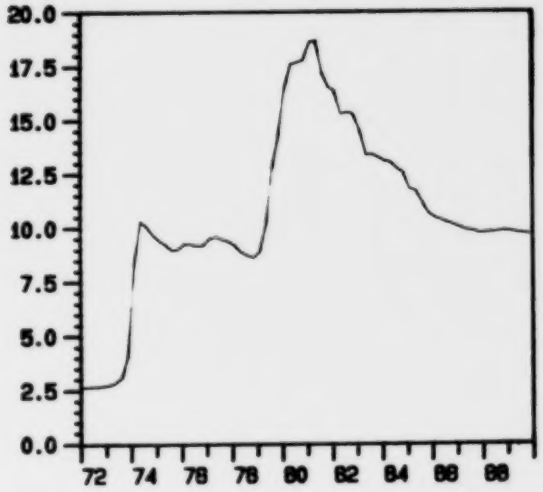



FIGURE 4. WORLD OIL PRICE (1972 US$)

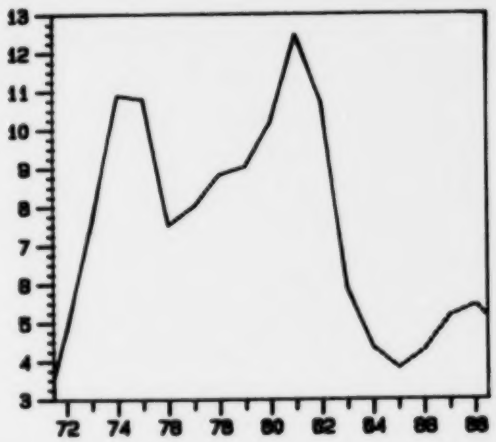


FIGURE 5. OIL INTENSITY (1971 = 100)

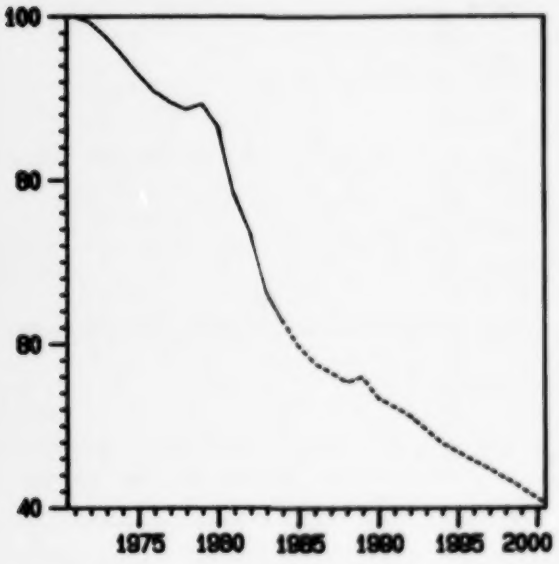



FIGURE 6. UNEMPLOYMENT RATE

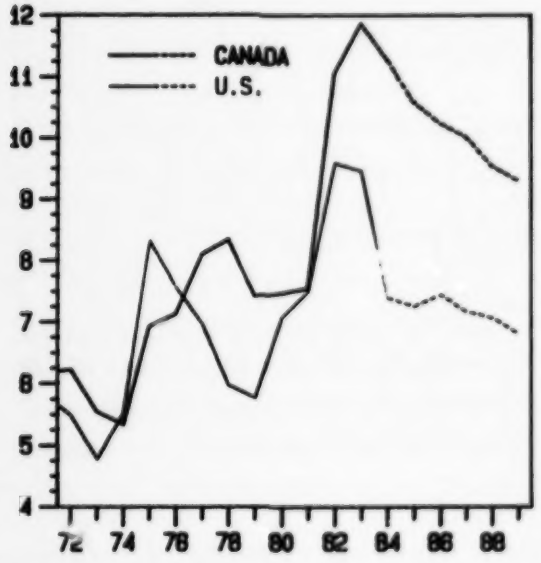



FIGURE 7. AVERAGE WEEKLY WAGES AND TOTAL EMPLOYMENT (% CHANGE)

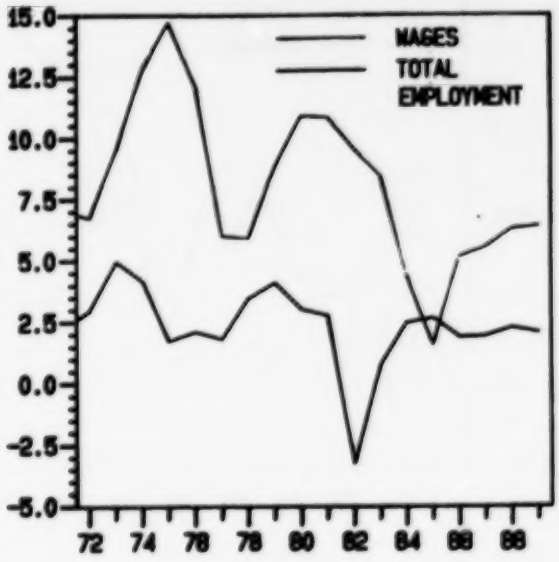



FIGURE 8. BEFORE TAX PROFITS AS A SHARE OF GNP

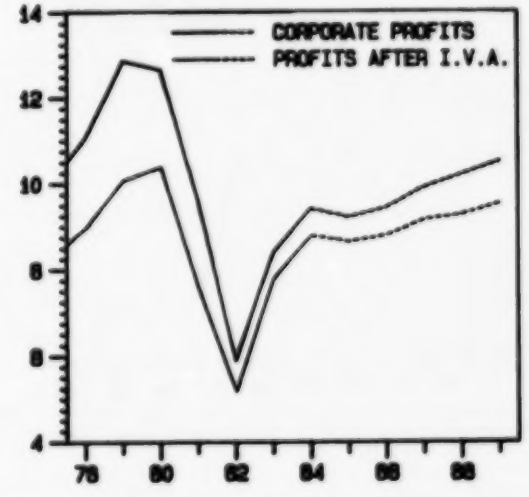


FIGURE 9. REAL INTEREST RATE – PRIME

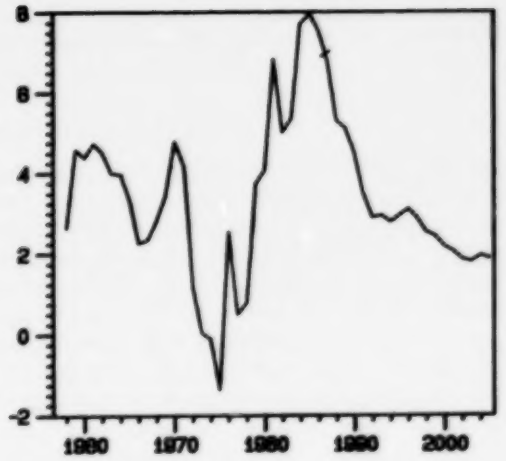



FIGURE 10. PRIME INTEREST RATES

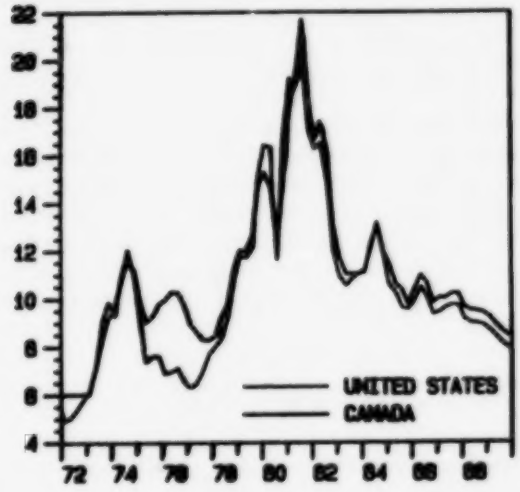
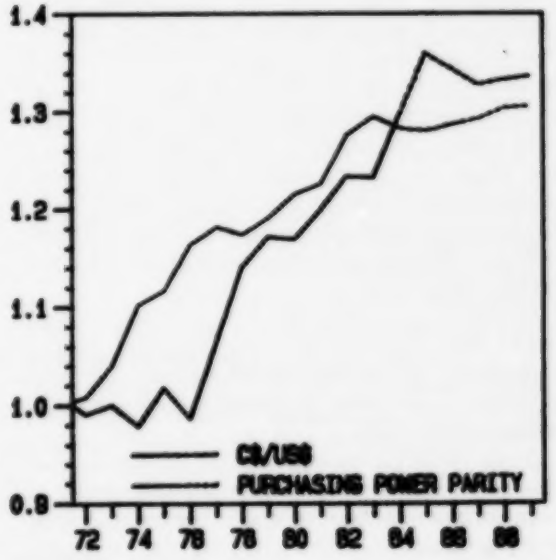



FIGURE 11. FEDERAL BALANCE NATIONAL ACCOUNTS BASIS ($B, SAAR)

FIGURE 12. EXCHANGE RATE



# WORLD AND NORTH AMERICAN AGRICULTURAL OUTLOOK

*James R. Donald*

Large global supplies of farm commodities dominate the agricultural outlook for the end of 1985 and for 1986. Farm prices and incomes are under pressure in several countries and carryover stocks are returning to the high levels of two years ago.

Bumper harvests in many world regions, especially the Soviet Union and the United States, and increased carryin stocks are boosting world crop supplies for the 1985/86 season. Global supplies of coarse grains, oilseeds, and cotton are especially large.

Crop consumption is rising worldwide. Economic recovery continues around the world and ample supplies of feedstuffs are encouraging high feeding rates. But the increase in consumption will not match the rise in production, so stocks will increase about 30%. Record global carryover stocks are projected for wheat, coarse grains, and soybeans.

Increased production or continued large production in some importing countries, notably the Soviet Union and China, will cause world agricultural trade in 1985/86 to decline. Wheat trade will show a substantial drop.

Intense competition will cause further shrinkage in farm trade shares for some countries, particularly the United States. U.S. farm exports, after dropping sharply in 1984/85 to $31 billion, are projected to drop even further in the coming year.

Global meat production should show a slight rise in 1986 because of larger pork and poultry production. World beef output will be held down by lower U.S. beef production because of a cutback in the herd.

Near-perfect growing weather in the United States this season produced record 1985 yields of corn, sorghum, oats, rice and soybeans and total crop production was the second highest on record. With large stocks carried over from 1984, total crop supplies far exceed likely use during the 1985/86 marketing year. Livestock producers this year are turning out record amounts of meat, poultry, and milk.

U.S. farm income is down sharply in 1985. In 1986, income will benefit from reduced beef output and higher livestock prices and possibly a further reduction in production expenses. But lower crop prices and receipts may be more than offsetting, resulting in lower net farm income. Crop prices in the first half of 1986 should strengthen because of heavy producer participation in Government programs and large stocks under loan. Second-half 1986 prices and marketings would be responsive to the enactment of new farm legislation.

The global agricultural outlook over the next several years is for continued gains in productivity, rises in product consumption, and a recovery in trade levels. The magnitude of increases in global agricultural trade will depend to a marked extent on import needs of the Soviet Union and China.

Several countries are closely examining agricultural and trade policies. New U.S. agricultural legislation is being developed in an environment highlighted by global production gains, slow consumption growth, dampened world trade, and deteriorating U.S. export market shares. For U.S. farmers, this has meant losses in income and financial stress. For the Government, it has meant large farm program outlays and contributions to mounting budget deficits.

## COMMODITY OUTLOOK

Changing production levels in the United States and the Soviet Union are key factors in the global agricultural outlook for 1985/86. U.S. crop output is expanding more than 6% from the 1984 level in response to improved growing conditions and higher yields. The U.S. livestock industry has been adjusting inventories downward during 1985, resulting in high slaughter levels and prices substantially below a year ago. But meat production now is easing and should slip below the year-earlier level in the fourth quarter of 1985 and remain at a reduced level until the fourth quarter of 1986.

In the Soviet Union, improved yields are increasing gain production by over one-tenth.

This increase, coupled with prospects for larger forage production and reduced livestock inventories, suggests a sharp cutback in Soviet grain imports in 1985/86 to about one-third below the 55 Mt of 1984/85.

## Crop production

Global output of major crops is increasing about 2 1/2% from last year's record, largely due to better growing conditions and higher yields for feed grains, soybeans, and cotton in the United States and for grains and cotton in the Soviet Union.

World coarse grain production is up substantially, responding to a sharp increase in U.S. and Soviet yields; but adverse weather is causing a significant reduction in yields and production in Eastern Europe.

The global oilseed outlook is highlighted by sharply higher U.S. soybean yields and the likelihood of continued large production in South America. Production of major oilseeds is indicated at a record of over 189 Mt. U.S. soybeans account for 7 Mt of the 8 Mt rise.

## Consumption and trade factors

World economic growth should continue at a moderate pace in 1986. In less developed countries, the pace of economic activity could improve slightly, benefiting from recent large exports to industrialized countries. Economic growth in the United States picked up in the third quarter after lagging in the first half because of liquidation of inventories and some slowing in consumer spending. Uncertainty over tax reform has also contributed to continued weakness in capital investment. However, inventory liquidation has probably run its course; and with interest rates much lower since last spring, better performance of the economy is expected to continue in the months ahead. Inflation is expected to remain at dampened levels with little demand pressure on capacity.

World meat production may show a slight increase in 1986 due to larger pork and poultry output abroad, as well as bigger U.S. poultry production. Also, better returns to U.S. cattle and hog producers should result in continued higher feeding rates.

Larger supplies, lower prices, continued economic growth, and a little higher livestock feed use should mean at least modest increases in global crop consumption in 1985/86. However, production will be up much more than use.

## Crop stocks

Global crop stocks are likely to be at record or near-record levels by the end of the 1985/86 marketing year. Coarse grain and soybean stocks are projected to rise over 50% to record levels, while a tenth more wheat is likely to be added to carryin stocks that were already at a record level.

Nearly all of the increase in global grain and soybean stocks will occur in the United States. The United States is expected to hold about 55% of global stocks, up from 43% at the beginning of 1985/86. Because of high participation in 1985 farm programs by U.S. producers, most of the increase in U.S. stocks this year may end up in government inventory.

## Trade

World farm trade levels will slip due to continued large or expanded production in several countries, including the Soviet Union and China.

There is intense competition for these smaller international commodity markets. The U.S. dollar has weakened in 1985, pointing to lower prices to importers. The dollar may weaken further in 1986, particularly if the pace of economic growth abroad rises relative to U.S. growth. Also, the United States has instituted a new Export Enhancement Program under which $2 billion can be spent over 3 years to improve U.S. export competitiveness by using CCC inventories to allow U.S. exporters to lower prices of certain commodities to selected markets. Total offerings by late November were the equivalent of about 5 Mt of wheat, with sales of about 1.2 Mt of wheat and wheat equivalent of flour.

Still, there will be further U.S. share losses because of increased competition from other countries. The volume of U.S. crop exports will fall nearly 13% from 1984/85, to 28% below 1981/82 level.

### Wheat

Wheat trade may be down with much smaller Soviet imports and a further reduction in imports by China. Projected global trade of around 91 Mt would be down more than 15% from last year's record and the smallest in 6 years.

The U.S. share of this reduced trade is expected to decline to 30%, from 35%, because of large supplies in other countries. The Canadian share should hold at last season's level of 18%. Increased shares are projected for the European Community (EC) and Australia.

Both the U.S. export volume and share have fallen every year since 1981/82. In early 1980s, the United States has faced both rising competitor production and a slowdown in global import growth as the world economy deteriorated and debt and credit problems affected many developing countries. With the 1981 Farm Bill setting rising support prices and with a strengthening dollar for most of the first half of the 1980s, competitor production and exports have been encouraged.

### Coarse grain

Coarse grain trade is expected to decline over 9% in 1985/86. Smaller imports are likely by the Soviets and Western Europe. The notable change in exports is for the United States. The volume of U.S. exports will be down around 12% and the U.S. share of the market will slip to 53%, down from 72% 6 years ago. Canada will account for 5% of the market, up from a low level of 3% in 1984/85. Larger market shares also will be gained by Argentina, South Africa, and Thailand.

World barley trade may decline around 12% in 1985/86, reflecting much smaller Soviet imports. Canada's exports may recover somewhat from last year. The Canadian share of trade could rise to nearly 24%, 13% above 1984/85. The projected U.S. share of 5% would be below last year's nearly 7%. The United States accounts for 7% of global output, slightly above Canada's 6% share.

In the 1980s, various factors depressed U.S. coarse grain sales and trade shares – the appreciation of the dollar, increasing U.S. support prices, the growth of EC barley exports, and the continued decline of EC corn imports. Despite record U.S. corn purchases by the USSR in 1984/85, the U.S. share of global coarse grain trade was the lowest in 10 years. Financial constraints have limited purchases by Eastern Europe and many developing countries, while U.S. support prices and a high-valued dollar have increased returns to competitors.

### Oilseed

Oilseed exports, in contrast to the grains, are expected to show a modest rise. Large oilseed product supplies and lower prices are expected to stimulate use and result in a 1% increase in trade.

The U.S. share of world oilseed trade is expected to show a slight recovery from last year's all-time low of 33%, if supplies are a little lower from South America. Canada's share of global trade is likely to remain at about 2%.

The U.S. share has been dropping since the 1970s, particularly for soybeans. Strong demand growth and relatively high prices for soybeans in the 1970s encouraged the emergence of Brazil and Argentina as major producers and exporters of soybeans. As a result, the U.S. soybean and meal market share graduularly for soybeans. Strong demand growth and relatively high prices for soybeans in the 1970s encouraged the emergence of Brazil and Argentina as major producers and exporters of soybeans. As a result, the U.S. soybean and meal market share gradually dropped from over 80% in the early 1970s to the mid-60 range by the end of the decade. In 1984/85, the United States had only 41% of a trade level reduced by depressed world demand.

Canadian oilseed exports have held their relative share of world markets better than U.S. oilseeds in recent years. Rapeseed, a high oil-content seed, has benefited from the strength of oil prices relative to those of meal. For 1985/86, however, a significant rise in world output of other oils, especially palm, slower gains in vegetable oil use in some major consuming countries, and a larger crush as meal demand picks up, have triggered a drop in vegetable oil prices. USDA analysts thus feel that Canada's rapeseed production and exports will do well to hold near their recent levels in coming years.

## Prices

Global commodity prices have been under pressure from large production and weak demand. This is expected to continue to be the case for crop prices in coming months, although prices could show some sensitivity to crop developments in the Southern Hemisphere.

Prices in the second half of 1986 and into 1987 will depend importantly on weather, economic, and policy developments, including new price support programs for the United States.

## U.S. AGRICULTURAL OUTLOOK

### Commodity overview

The outlook for large U.S. crops and weak exports points to a further building of stocks of wheat, feed grains, soybeans, and cotton. Domestic use should be supported by better livestock returns and high feed rates in the coming months. However, except for soybeans, export markets for these crops are expected to be smaller in 1985/86.

The total value of U.S. exports is expected to decline to $29 billion, 7% below fiscal 1985 and 34% lower than in 1981. The projected export volume of 120 Mt is 43 Mt below the 1980 peak.

Lagging total crop use and large supplies in 1985/86 point to considerable downward price pressure. Prices should receive some support from high program participation and heavy loan entries.

U.S. meat production reached a record high level in 1984, and 1985 probably will see that record surpassed. In 1986, total meat production is expected to decline about 1%. Beef production rose in 1984, mainly reflecting liquidation of the breeding herd. In 1985, beef production will change little from the 1984 level. Cow slaughter is off sharply, but fed beef slaughter is up. Also, record slaughter weights have helped hold beef production up this year. In 1986, beef production should decline as both fed and nonfed slaughter drop and dressed weights fall from this year's highs.

Pork production was off in 1984 and it will change little this year. The breeding inventory was down in September, and producer farrowing intentions showed that smaller pig crops were likely through this winter. Production likely will be below year-earlier levels in first half of 1986 but could be up slightly in the last half. For all of 1986, little change in output is likely.

U.S. imports of hogs and pork products were up sharply in 1984 and they continued at higher levels into 1985. Live hog imports, all from Canada, have dropped below the year-earlier level in recent months. This drop in live hog imports was in response to a countervailing duty. Live hog imports are expected to continue down in 1986.

Pork product imports, primarily from Canada and Denmark, have continued above year-earlier levels. When countervailing duties were placed on live hog imports, the International Trade Commission found that pork products were not injuring the U.S. industry. As a result, pork product imports from Canada remain at a high level. For the year, pork imports from Canada are expected to be up from a year earlier, but a small decline is likely for 1986.

Total 1986 U.S. imports from Canada, live hogs plus pork products, are likely to equal almost 4% of U.S. pork production. This would be near an estimated 4% in 1985 and 4% in 1984.

Poultry meat production has continued to increase in 1985 and this probably will be the case in 1986 as favorable returns for poultry producers continue.

Milk production is rising an estimated 5.8% to a record 143.2 billion pounds in 1985, boosted by renewed dairy herd expansion following the end of the diversion program and strong gains in output per cow. Assuming that a diversion program is not reinstated in 1986 and that milk support prices remain at $11.60/cwt, production could rise further next year as herds are little changed but yields continue to recover from the diversion program. However, much will depend on the dairy program adopted in 1985 farm legislation. Farm milk prices are easing this fall and for all of 1985 may average 60–80¢ below the 1984 all-milk average price of $13.45/cwt.

### Farm income

Total net farm income in 1985 is estimated more than one-fifth below 1984's increased level of $34.5 billion. The lower estimate reflects large commodity supplies, reduced prices, and a reduction in the value of the livestock inventory.

Production expenses may decline moderately in 1985, reflecting lower prices and reduced use of production inputs. But gross income is falling more than production expenses, leaving less net farm income. Net cash income, with no inventory adjustment, could match or exceed 1984's $39 billion.

The 1986 outlook is for a small decline in marketing receipts as higher cattle and hog prices are offset by lower crop prices. Production expenses may also slip, but not as much as marketing receipts, so net cash income could be slightly lower. Net farm income could be down more than cash income, if inventories are drawn

down. Policy changes and weather developments will influence the outcome.

## Program participation

Producers removed about 34 million acres from crop production in 1985, up from 1984s 27 million. Participation for each crop increased from 1984 levels. Harvested acreage of 15 major crops plus acreage put to soil conserving uses totaled about 294 million acres in 1985, second only to the 300 million acres in 1983. The approximately 260 million acres for harvest in 1985 are producing crops well in excess of demand levels.

## Net outlays

Net outlays for price support programs increased sharply in fiscal 1985 to around $16.8 billion, second only to the high of $18.9 billion in 1983. Loans made from the 1984 crop increased sharply, as did direct cash Government payments, particularly feed grain deficiency payments. Fiscal year 1986 outlays likely will be another year of heavy outlays with increased commodity entries into the loan and large deficiency payments.

## Food prices

Continued slow inflation in the economy and relatively large food supplies are holding down the 1985 increase in food prices to 2 to 3%. So far in 1985, price gains have been closer to the lower end of the range, although there may be some pressure from tightening red meat supplies in the months ahead. Beef supplies are expected to show the sharpest declines.

The outlook for 1986 is for continued moderate inflation in the economy and relatively large food supplies, with meat supplies down only about 1% because of larger poultry output. The increase in food prices is likely to be modest in 1986.

# LONGER TERM PRODUCTION AND TRADE PROSPECTS

The global capacity to produce agricultural products is outpacing market demand so far in the 1980s. Commodity output has been spurred by productivity gains, while demand has been dampened by the economic turndown and slow recovery.

The outlook for the next several years is for continued productivity gains as present and new technology is adopted. Demand for agricultural products should improve with economic growth, although the pace of demand growth is unlikely to match the 1970s.

## Productivity potential

There is much potential for productivity increases over the next 5 to 10 years. Technological advances will mean greater animal product production and increased plant yields. But productivity gains are not 5 to 10 years away; they are being achieved now.

For major crops, for example, U.S. yields have gained over a tenth in the past decade, more than double in the increase in crop acreage. If the United States is removed from the global average, gains have been more impressive in other countries. Average yields are up nearly one-fifth in 10 years.

Crop yield increases can be achieved, even without major technological breakthroughs, by switches to higher yielding varieties and adoption of improved management practices. Wheat provides a good example, where producers in some countries are switching to higher yielding soft wheat varieties.

Wheat yields in the United Kingdom, for example, average 4 times the Canadian average, and are 70% above 10 years ago. In the United States, yields are averaging nearly one-fourth higher than in 1976. The availability of hybrid varieties and new advances in technology add to potential productivity gains for wheat, as well as for other crops.

## Demand prospects

Global demand for agricultural products is expected to expand over the next several years, encouraged by Government policies and stimulated by continued gains in economic activity, population growth and large commodity supplies. The key question is whether the demand growth will be met by domestic production or through trade.

Two countries, the Soviet Union and China, have had a major impact on world commodity trade levels in recent years; and this likely will be the case in the next several years.

### Soviet

Soviet grain imports have been at record levels in the early 1980s and net imports have accounted for about one–fifth of domestic use, up from around 5% in the early 1970s.

Soviet feed use of grain has remained large since 1976/77 – in most years around 122 Mt of all grains with wheat equalling generally 35% and coarse grains 65%. However, feed use has fluctuated from year to year and ranged from 116 to 119 Mt in the early 1980s.

Per capita meat consumption in the Soviet Union has been trending upward. Meat production has been increasing; but in some years, the Soviets have supplemented their domestic production with large imports of meat. In 1984, total meat production was up only slightly, while imports declined almost one–fifth, resulting in almost no change in per capita consumption. Meat production is showing a slow growth in 1985, but a larger increase is likely in 1986. Meat imports are down and likely will drop again in 1986 if production rises as expected.

### China

China's level of grain imports and the share of domestic use from imports have trended downward in recent years. Increased production and greater self–sufficiency for both grains and cotton have led to reduced imports.

In the 1970s through 1982/83, China sharply increased corn imports; but in recent years, imports have almost stopped. Indeed, China is expected to export about 3.5 Mt of corn in 1985/86. Huge production increases in recent years have caused a buildup in China's corn surplus which cannot be absorbed domestically due to inadequate inter–provincial transportation and a limited feed industry. However, the Government has issued an ambitious plan to increase domestic production of mixed and compound feed from 10–12 Mt in 1984 to 50 million by 1990 and over 100 million at the turn of the century. This may indicate that increased production of compound feed in large plants in major cities will be based on imported corn, but much of the increased production of simple mixed feed may be in rural areas relying on using local grain surpluses. The potential for large corn imports exists as current per capita meat consumption is relatively low.

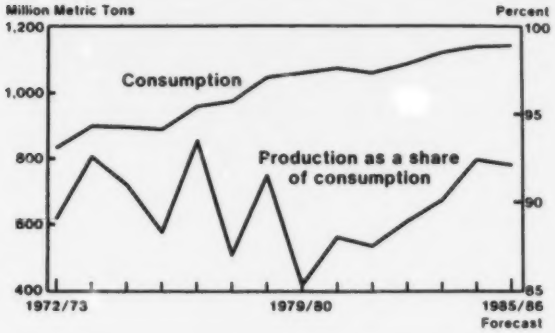
Per capita pork consumption in China has shown an upward trend over the past several years. China is the largest pork producing country; but per capita consumption is far below levels for European countries, the United States, and Canada. China exports some pork. Production is expected to continue its upward trend this year and again in 1986.

## LEGISLATIVE DEVELOPMENTS

The U.S. Congress is now finalizing the new agricultural legislation in an environment of continued imbalance between commodity supplies, enlarged by productivity gains, and weak growth in world demand and trade. Central concerns are the financial stress facing farmers, continued losses in farm exports, and the need to reduce the budget deficit. Solving these problems has required a hard look at both traditional farm policies and trade policies.

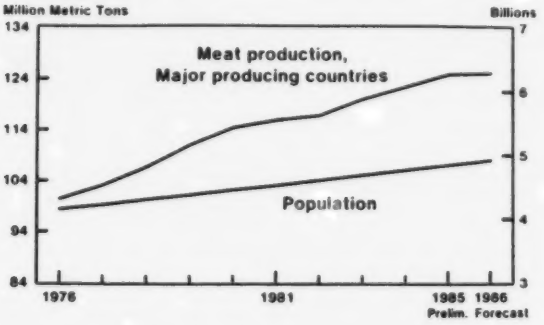
Provisions of the bills considered by the Congress reflect two different philosophies. One holds that a more market–oriented and less Government–run farm policy is needed to make farm exports more competitive and return prosperity to agriculture. This philosophy is behind the Administration's farm bill proposals. However, some hold that more, not less, intervention is required to guarantee high farm prices.

## FIGURE 1 CONSUMPTION OF WHEAT, COARSE GRAINS, AND SOYBEANS, WORLD LESS U.S.

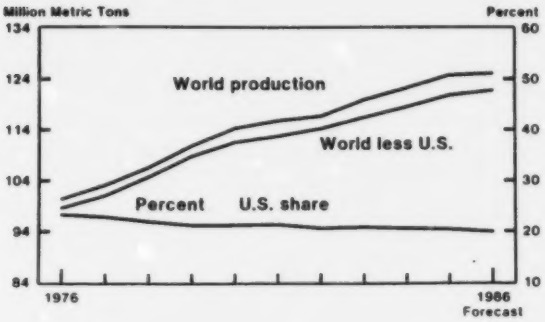



## FIGURE 2 WORLD GNP GROWTH RATE

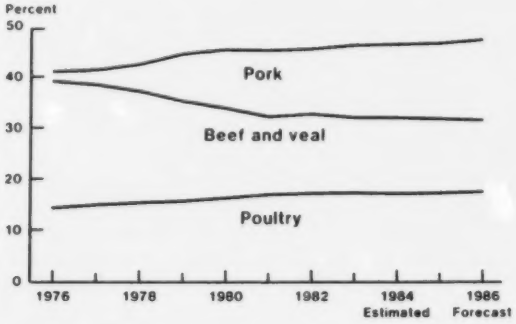
## FIGURE 3 WORLD MEAT PRODUCTION AND POPULATION



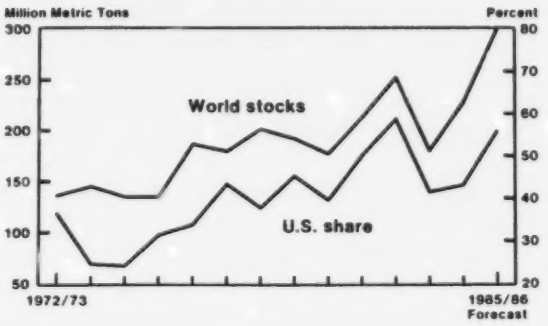

## FIGURE 4 MEAT PRODUCTION



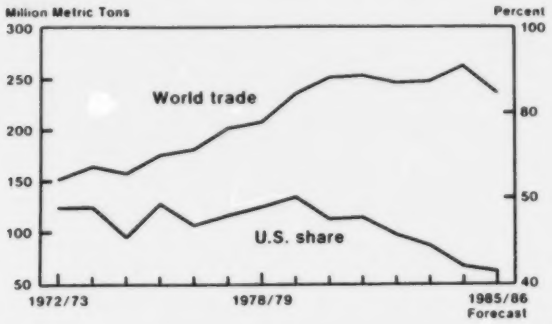

## FIGURE 5 MEAT PRODUCTION SHARES, WORLD LESS U.S.



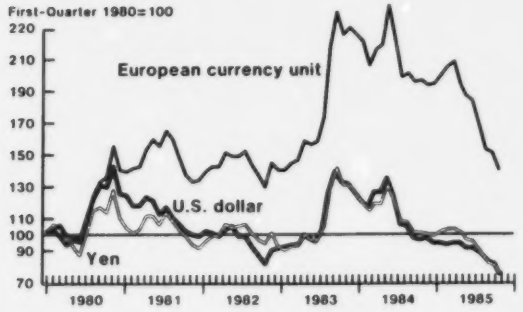

## FIGURE 6 WORLD CROP STOCKS OF WHEAT, COARSE GRAINS, AND SOYBEANS



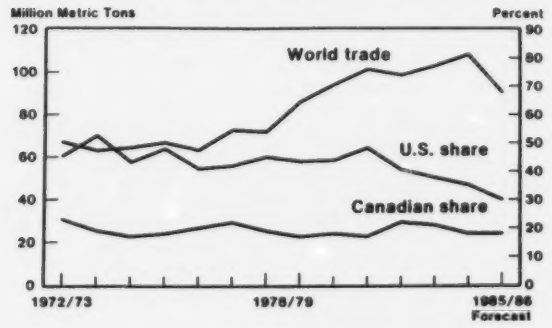
## FIGURE 7 WORLD TRADE IN WHEAT, COARSE GRAINS, AND SOYBEANS



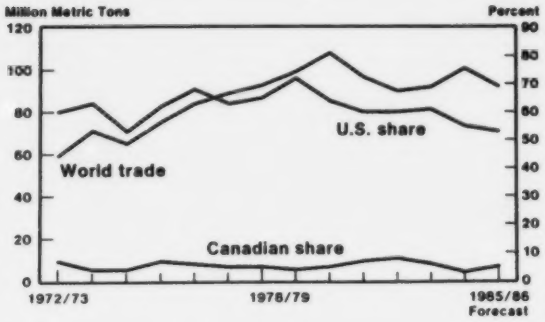

## FIGURE 8 EXCHANGE RATE EFFECT ON U.S. SOYBEAN EXPORT PRICE, GULF PORTS



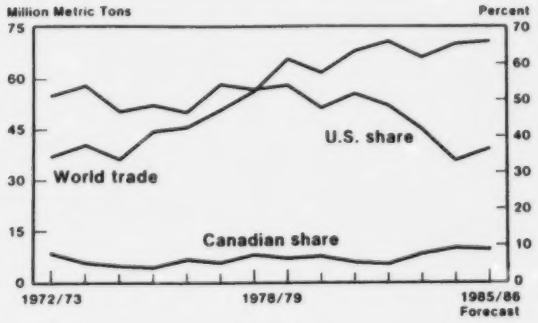

## FIGURE 9 WORLD WHEAT TRADE



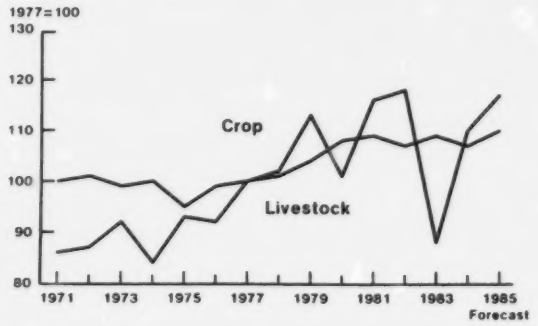

## FIGURE 10 WORLD COARSE GRAINS TRADE



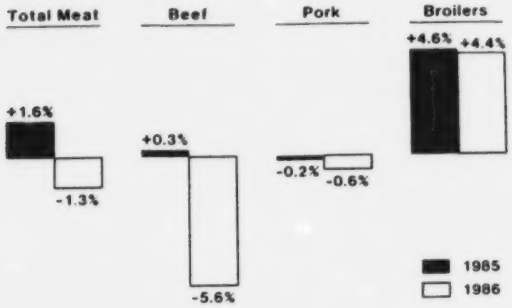

## FIGURE 11 WORLD OILSEEDS TRADE



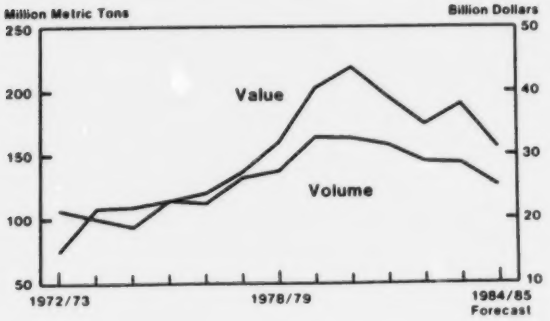

## FIGURE 12 U.S. CROP AND LIVESTOCK PRODUCTION



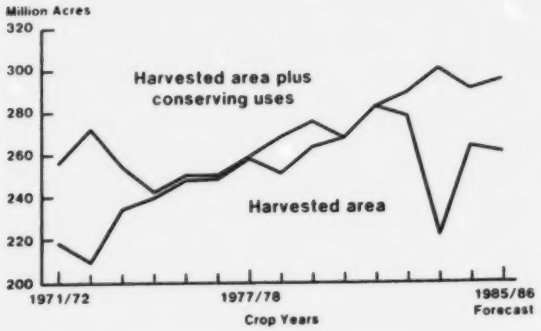
## FIGURE 13 U.S. LIVESTOCK PRODUCTION, CHANGE FROM PREVIOUS YEAR, FORECAST



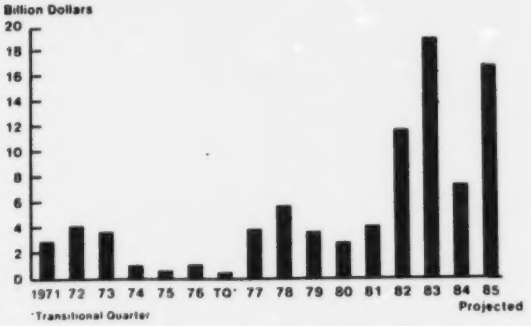

## FIGURE 14 U.S. AGRICULTURAL EXPORTS



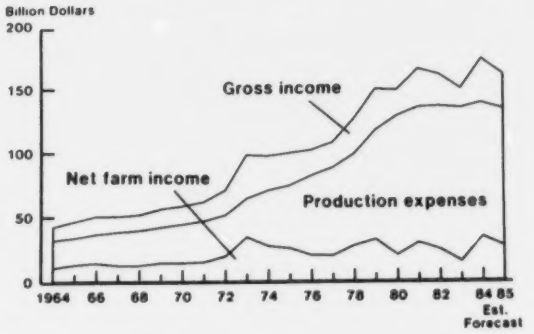

## FIGURE 15 U.S. AREA HARVESTED PLUS CONSERVING USES



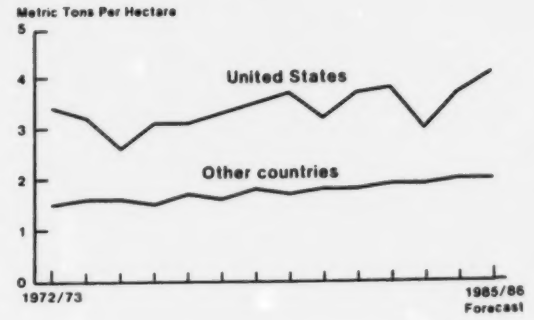

## FIGURE 16 NET OUTLAYS FOR FARM PRICE SUPPORT PROGRAMS



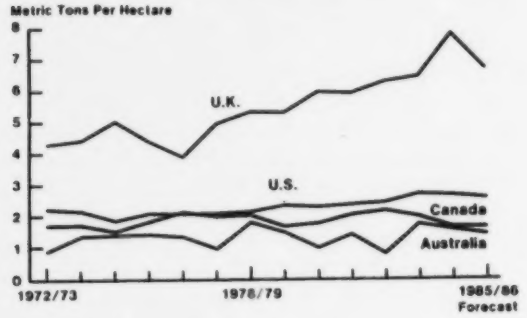

## FIGURE 17 AGGREGATE FARM INCOME



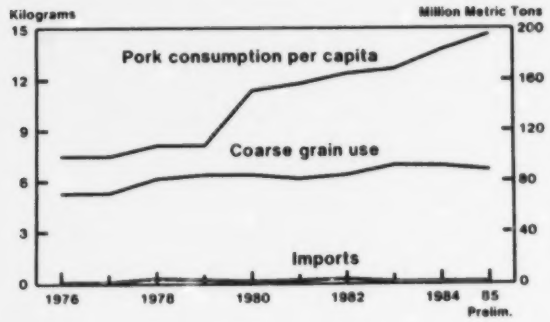

## FIGURE 18 CROP YIELDS, WHEAT, COARSE GRAINS, SOYBEANS



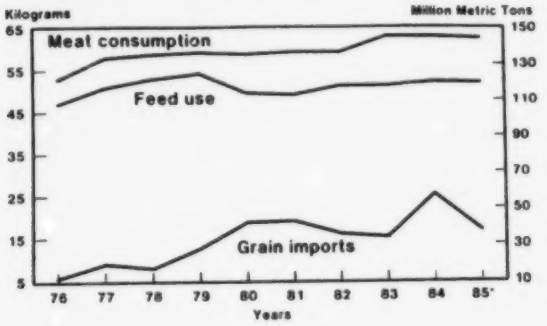
## FIGURE 19 WHEAT YIELDS




## FIGURE 20 CHINA'S PORK CONSUMPTION, COARSE GRAIN USE, AND COARSE GRAIN IMPORTS




## FIGURE 21 SOVIET UNION: PER CAPITA MEAT CONSUMPTION, FEED USE, & GRAIN IMPORTS



# CANADIAN AGRICULTURAL OUTLOOK 1986-90

*H. Bruce Huff*

## INTRODUCTION

The main features of the Canadian agricultural outlook for 1986 and 1987 will be highlighted in this paper. As well, an overview of the medium-term outlook to 1990 will be presented. Finally, the implications of three alternatives to the medium-term forecast will be discussed: first, a different outcome for the U.S. farm program, leading to lower-than-expected commodity prices; second, a stronger Canadian dollar; and third, stronger economic growth in Canada. More detailed presentations of the outlook for major commodities and food prices will be discussed in the simultaneous sessions tomorrow morning.

The medium-term outlook for Canadian agriculture can be conveniently summarized in terms of overall commodity prices and output, and food prices. Gross domestic product (GDP) in agriculture is expected to increase 4.3% in 1985, after declining in both 1983 and 1984. A second consecutive year of drought in Western Canada prevented a stronger recovery from already low levels of crop production. For 1986, GDP in agriculture is forecast to increase by 1.7%, followed by a similar increase in 1987. From 1988 to 1990, GDP is expected to rise each year, with growth averaging 1.9% for the period. An important assumption underlying these output forecasts is that crop yields return to trend values over the forecast horizon. For the five year period 1986-90, average annual production growth is expected to be almost 1% below the previous ten year average of 2.8%.

Farm prices of agricultural products are expected to fall about 5% in 1985, the biggest one year decline in 30 years and reflects current weakness in both crop and livestock prices. For 1986, a slight increase of 0.4% is forecast, as livestock prices increase in response to lower supplies but crop prices continue to decline. For 1987, the forecasts are for continued declines in crop prices and slightly lower overall livestock prices (primarily due to lower hog prices), implying about a 1% decline in farm prices. Over the period 1988-90, prices of both crops and livestock are forecast to increase each year, resulting in average annual increases of 3% for overall farm prices. Thus, 1990 prices will only be slightly above those of 1984.

Retail food prices are estimated to increase about 3% in 1985, and are forecast to rise between 2 and 4% in 1986. For 1987, a slight increase in food price inflation is possible, and over the period 1988 to 1990 food prices are projected to increase about 4% per year on average. Thus food prices are expected to increase at approximately the same rate as the total consumer price index for the next five years.

Before discussing the more detailed commodity outlook, it should be noted that the outlook for Canadian agriculture is based on certain assumptions regarding general economic conditions, and international agricultural policies and trends. These factors will now be reviewed, and the current agricultural situation summarized.

## Canadian macroeconomy

The Canadian macroeconomic outlook implies that the agricultural sector can expect only moderate growth in domestic food demand but reduced cost pressure for the remainder of the decade. The Canadian economy is expected to display relatively modest growth in 1986 and 1987, and slow somewhat more over the remainder of the decade, according to the Conference Board in Canada. Real Gross National Product (GNP) is expected to increase 4.1% this year, but only 2.7% in 1986, 2.4% in 1987, and 1.4% over the 1988-90 period.

Growth in real disposable income is expected to remain virtually flat next year, around 0.6%, compared with 4.2% in 1985, but rise to 2.4% in 1987, with an average of 1.9% for 1988-90. Inflationary expectations are forecast to be moderate. The Consumer Price Index (CPI) should decline slightly over the next two years to 3.3% and average 4.2% in 1988-90.

The Canadian dollar should remain at approximately 73-74¢ U.S. Interest rates are forecast to stay relatively stable and energy prices to remain unchanged in real terms in 1986-87 and rise slightly more than 1% in 1988-90.

## World agricultural outlook

Little optimism can be drawn from a review of world commodity markets. Prices for most commodities are at low levels,[1] high stocks of many commodities exist, a number of countries are increasing their support for agriculture and, hence, continuing production increases appear likely. As a consequence, many countries facing low farm incomes and surplus problems are expanding exports through subsidies and increasing their protection against imports.

Despite this rather gloomy worly commodity outlook, there are small glimmers of light in the world economy. During the past year, debt problems of developing countries have been managed successfully, aided by stronger growth in OECD countries (and thus import demand), declining interest rates, and developing country programs to expand exports. Canada (and the U.S.) may also benefit from a decline in its exchange rate with other OECD countries. From the beginning of the year to the end of November, there has been a 31% devaluation against European Currency Unit (ECU) and 30% against the Japanese Yen. As well, oil prices are likely to hold steady in the next one to two years. Nevertheless, a slowdown in the growth rate for OECD countries, especially the U.S., expected in 1986, is likely to have a ripple effect, particularly for South Asian and Latin American countries, important markets for Canadian agricultural products.

## Current agricultural situation

Total agricultural production in Canada will rise 4% in 1985, after two poor years in 1983 and 1984. The slow growth is due primarily to the second consecutive drought in Western Canada, which reduced wheat yields 10% below its trend value. The value of wheat production will drop even further, as the wet harvest in Western Canada lowered the proportion of number one wheat from the usual 50% level to about 20% in 1985/86. Meat and poultry production was also higher in 1985. Beef production increased approximately 1% at the expense of a continued decline in the cow herd in Western Canada. Pork production rose 3% in 1985, although the fourth quarter decline marked the first down turn since 1983. Chicken production remained strong, rising another 10% again in 1985. Turkey production will likely be up 5% this year. Other supply managed commodities are expected to decline slightly in 1985, with egg production down less than 1% and total milk shipments falling about 2% due primarily to adjustments over two dairy years to the smaller Special Export Program. Production of potatoes and apples rose in 1985, while tobacco and other vegetable production remained at year earlier levels.

Farm commodity prices are estimated to drop approximately 5% in 1985. Lower prices are widespread, with milk being the only major commodity to increase in price over last year. Wheat and coarse grain prices declined as world supplies continued to expand, export subsidy wars escalated and imports by the USSR declined. Oilseed prices plummeted as world edible oil supplies returned to more normal levels. Livestock and poultry prices declined 2% in 1985 due to the decrease in feedgrain prices and the continued ample supply of red meats on the North American market. Potato prices fell sharply, as North American supplies are at record levels.

Retail food prices in 1985 are expected to increase about 3% over last year's level. Above average increases in 1985 will occur for beef, turkey, dairy products, bakery products, fruit, and fats and oils. Large price declines were observed for chicken and potatoes. Canada's agricultural exports are likely to fall about 10% in 1985, largely on the basis of the lower value of wheat, barley and canola exports. This is the first decline in over 10 years. Total agricultural exports of $9.1 billion are forecast to exceed imports of about $6.9 billion to provide a trade surplus of $2.2 billion, about one half of the 1984 level.

## OUTLOOK 1986–1990

## Grains and oilseeds

Based on a normal weather scenario, 1986 Canadian cereal production is projected to increase 6%, with wheat production expected to rise 12% and barley 2%. The large increase in wheat production will occur as a result of increased yields and a small increase in acreage encouraged by the record low stocks of top quality wheat. Ending stocks of cereals, particularly wheat, will increase substantially in 1986/87 due to the large increase in production and only a moderate expansion in exports. Oilseed acreage will likely decline 11% as a result of low oilseed prices relative to cereals.

In the medium term for Canada, production of wheat and barley is expected to increase at a moderate 3% per year between 1987 and 1990, due to both expanded acreage (from reduced summer fallow) and increased yields. Oilseed production will likely increase about 5% annually, although the acreage of oilseeds is not expected to exceed 1984 levels in the medium term. Export levels are expected to remain below historical highs until at least 1988 for wheat and barley. Oilseed exports are anticipated to remain close to previous years' levels. If these export levels are attained, no large accumulation of stocks is foreseen.

World production of wheat and coarse grains may be slightly lower next year. In the United States, the acreage reduction program is expected to be expanded. The EEC production should remain below the record 1984 crop. Nevertheless, burdensome world stocks and sluggish export demand will combine with expected lower U.S. loan rates and increased world competition to depress cereal prices further in 1986. World trade should increase gradually in the medium term. The decrease in imports this year by the centrally planned countries is not expected to be repeated and future imports of grains should remain near current levels.

World cereal prices should be approximately 5 to 10% lower in 1985/86, although oilseed prices are expected to remain at their present levels for the rest of the crop year. Smaller supplies of high quality wheat will limit its price decline. Based on the expected provisions of the U.S. Farm Bill, with lower loan rates, this will likely continue to create downward pressure on world grain prices. With world stocks at record levels, increased world competition, and weak markets, Canadian export prices will likely drop another 10% for wheat and 5% for barley in 1986/87. Feedgrain prices on the prairies will also drop next year as farm stocks are replenished and as world feedgrain prices decline. In the medium term, feedgrain prices should improve slightly in 1987/88, whereas wheat prices will not likely strengthen until 1988/89. It is not expected that wheat prices will reach the levels seen in 1981 until 1990/91. These price forecasts are based on provisions that are expected to be contained in the new U.S. farmbill and certain assumptions concerning world supply and disposition conditions.

## Red meats

Divergent world and North American livestock production patterns will continue to strongly impact on the Canadian market during the next few years. In 1986, total red meat production in North America is expected to be down 4%. Pork production in the U.S. is likely to be down 1% in 1986, lower in the first half but expected to increase in the second half. Beef production in the U.S. may decline 4–6% in 1986, reflecting the low calf crop of 1985, lighter carcass weights and an end to the liquidation of the breeding herd.

Supplies of low quality beef should increase in international markets. Stocks of beef are continuing to build rapidly in the EEC, and currently are about 1 Mt. A proposed new dairy herd reduction program in the EEC should aggravate this surplus. Cattle herd rebuilding is also occurring in Australia and New Zealand as currency devaluations have increased their producer prices. Provisions in the impending U.S. Farm Bill could also increase the slaughter of dairy cows.

Canadian production of red meats should also be down in 1986. Pork production should be 3–4% lower in the first half but slightly higher in the second half. Canadian beef production should be down about 5% in 1986, reflecting the lower calf crop, higher exports of feeder cattle, fewer dairy cows slaughtered, and a decline in breeding herd liquidation.

In 1987, Canadian pork output is expected to be 3% higher, continuing the increase of the second half of 1986. Thereafter, with relatively stable hog and feed grains prices, pork output is expected to increase, on average, by less than 1% per year. Canadian beef output should decline by 4% in 1987 as a result of herd rebuilding. Beef output may start increasing as early as 1988. However, no major rebuilding of herds is anticipated, so that by 1990 beef production would not reach current levels.

Red meat prices in 1986 are expected to be higher with the anticipated big decline in U.S. beef production. Toronto steer prices are expected to be up nearly 6% and hog prices by about 11%. For 1987 and 1988–90, high levels of poultry production and modest increases in pork production should offset the low levels of beef production in North America and positive economic growth to moderate the average steer price increases to around 1%. Lower hog prices

(5%) in 1987 will reflect higher North American output, and for 1988–90 no upward trend is foreseen in hog prices.

## Poultry and eggs

Lower feed costs will continue to reduce poultry and egg farmgate prices in 1986. Egg prices should be 6% lower and turkey prices 2% lower. Continuing high demand and low stock levels may result in slightly higher broiler chicken prices. Farm prices for poultry and eggs should increase moderately in 1987 (2%) and 1988–90 (4% annually). Chicken prices may, however, decline 4% in 1987 as stocks return to more normal levels.

Moderation from the very rapid annual increase in chicken production is anticipated in 1986 (4%), and again in 1988–90 (3.5%). Higher turkey production is anticipated in 1986 (2%) and a 2–3% annual increase is expected during 1987–90. Egg production is expected to continue near current levels during 1986–90.

## Dairy products

Industrial milk shipments in 1986 are expected to be near 47 Mhl, a slight increase over the 1985 level. The 1985–86 Market Share Quota has been set at 46.6 Mhl, a 2% decrease over the original 1984–85 dairy year level. Reduced butter inventories will likely result in lower cheese production and exports in 1986. Exports of concentrated milk are also likely to decline because of reduced production for the Special Export Program in response to lower returns to producers. Domestic industrial milk requirements are forecast to increase slowly, by less than half of 1% in both 1986 and 1987. The loss in butter consumption should be offset by the growth in cheese consumption, especially specialty cheeses.

As a consequence of moderate inflation rates and low corn and soymeal prices, industrial milk prices under the current target returns formula are forecast to increase by less than 2% in each of 1986 and 1987, and by 3% annually for 1988–90, due to the anticipation of stronger feed prices toward the end of the decade. Small increases in industrial milk requirements are expected during the 1987–89 period as a result of the upward trend in domestic cheese disappearance.

Large surpluses of butter and skim milk powder have depressed international markets. This imbalance is expected to continue in 1986 as little change is expected in the EEC or the U.S. to reduce large stocks.

## Horticulture and special crops

Canadian fruit production is expected to increase in 1986 as a result of improving yields and new plantings. Apple production during 1986–90 is expected to average 3–5% higher each year, and with a similar increase expected for tender fruit and berries.

Despite very poor potato prices this year, production in 1986 is not expected to change very much from that of 1985. An average annual growth rate of 3% is expected for potatoes for the remainder of the 1980s. However, extremely low prices for two or three years could reduce this rate.

A continuation of stiff export price competition for flue-cured tobacco will limit Canada's share of the world market in 1986. Domestic cigarette demand is expected to decline by up to 3.5% in 1986 as a result of increased retail cigarette prices and consumer awareness of the danger of smoking. Demand for cigarettes would trend downward by about 2% annually during 1986–90. Tobacco production will decrease in response to slower export sales as well as the decline in domestic demand.

World sugar stocks are forecast to decline for the first time in four years during 1985/86, but large stock levels and high price supports in many countries will maintain relatively low prices for free market sugar. Shortfalls in production could strengthen sugar prices somewhat, but a price boom is unlikely to occur during the 1986–90 period.

## Areas of uncertainty

The medium-term outlook presented in this paper is considered to be the most probably outcome given various assumptions, including the general economy and international policies. However, the forecasts are subject to the risk that changes in assumptions will alter the agricultural outlook. For this reason, three alternatives to our underlying assumptions have been analyzed to assess their impact. These alternatives look at the U.S. Farm Bill, the Canada–U.S. exchange rate, and Canadian economic growth. In each case, comparisons are made relative to the most likely medium-term forecasts already presented.

## U.S. Farm Bill

The U.S. congress is currently in the final stages of revising the Farm Bill. The latest versions of this legislation indicate that, for grains, lower loan rates of approximately 15% and a large acreage reduction program are likely starting in the next crop year. There is considerable debate as to what the level of crop prices will be in the medium term. An alternative to the most likely forecast maintains that crop prices will not rise above the substantially-reduced 1986/87 prices in the medium term. This assumes that acreage reduction programs will not be sufficient to deplete stocks and increase prices much above loan rates. Consequently, in this alternative, both crop and livestock prices are lower than in the most likely forecast beginning in 1987/88 and continuing over the forecast horizon.

Under this alternative, average farm prices in Canada would remain virtually flat from 1988 to 1990, compared with our most likely forecast of 3% average growth. Food price inflation also would decline by 0.6 percentage points. The level of output is only slightly lower, but the average increase in farm cash receipts would fall by 3.5 percentage points, to 1.6%/year. Growth in farm expenses would also slow, but not enough to offset lower cash receipts, resulting in lower farm income compared to the most likely forecast. The impact on Canadian barley prices is illustrated in Figure 1.

## Exchange rate scenario

The forecast assumes that the Canadian dollar will not strengthen appreciably relative to the U.S. dollar over the medium term. However, in light of recent international efforts to lower the value of the U.S. dollar relative to other major currencies, it is possible that the Canadian dollar may experience more substantial gains. For the purposes of this alternative, the Canadian dollar was assumed to be 5¢ higher than in the most likely forecast over the entire medium term, in which case the average value in 1986 rises from 73¢ U.S. to 78¢.

Under this alternative, most of the change occurs in 1986. Farm prices would decline almost 2% in 1986, rather than increasing slightly as in the base forecast. Slightly lower rates of growth for agricultural prices would persist over the medium term, about 0.3% points lower than the baserun from 1988 to 1990. Food price increases would moderate by about 1% in 1986. The increase in farm cash receipts for 1986 would be about 2% points lower, and again would more than offset a lower increase in farm expenses, resulting in lower farm income levels.

## Canadian economic growth

As previously indicated, the Canadian economy is expected to experience modest growth for the next two years, and then slow somewhat for the remainder of the decade. Under this alternative Canadian economic growth is assumed to increase per capita disposable income by one percentage point over the base forecast each year from 1986 to 1990.

Under this scenario, farm prices and food prices are not significantly different from those in the base forecast. However, increased domestic demand for food products leads to somewhat higher agricultural output, cash receipts, and farm income. From 1988 to 1990, for example, cash receipts would average about $100 million higher than in the baserun.

## Forecast summary

In summary, the outlook for 1986 indicates modest improvements over 1985. Much higher prices but lower production is forecast for red meats, in sharp contrast to cereals. Oilseed production will be down. Larger poultry and egg production is anticipated with lower prices reflecting reduced feed costs. Tight supplies may boost chicken prices, however. Little change is expected in dairy markets. Retail food price increases will be the lowest since the early 1970s. In the longer term, grain prices are expected to strengthen, which will raise production costs and prices for dairy and poultry products. Weaker livestock prices are anticipated in 1987 and, thereafter, modest increases. Slower rates of output for agriculture are anticipated over the next five years, as livestock herds are rebuilding, the industry faces reduced economic incentives, and domestic demand for supply managed commodities, especially milk and eggs, will grow slowly. Largest gains will come from grains and oilseeds, chicken, and apples and other tender fruits.

[1] The World Bank food commodity price index for 1985 has fallen 25% since the 1977-79 period and 47% since the 1980 peak.

## TABLE 1 CANADIAN COMMODITY PRODUCTION FORECASTS[a]

| | 1985 | 1986 | 1987 | 1988–90 |
|---|---|---|---|---|
| | | percentage change | | |
| Wheat | 13 | 12 | 3 | 3 |
| Coarse grains | 12 | 0 | 4 | 2 |
| Oilseeds | 8 | –12 | 4 | 5 |
| Beef | 1 | –5 | –4 | 2 |
| Pork | 2.7 | –1 | 3 | 1 |
| Chicken | 10 | 4 | 3.5 | 3 |
| Turkey | 5 | 2 | 1.5 | 3 |
| Eggs | 0.6 | 1 | 0 | 0.3 |
| Industrial milk | –3.7 | 0.3 | 0.6 | 0.7 |
| Total output (GDP) | 2.3 | 3.8 | 1.7 | 1.9 |

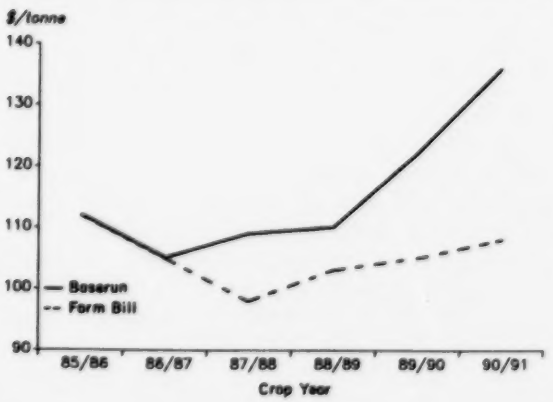
[a] Mean of forecast range

## TABLE 2 CANADIAN COMMODITY PRICE FORECASTS[a]

| | 1985 | 1986 | 1987 | 1988–90 |
|---|---|---|---|---|
| | | percentage change | | |
| Wheat[b] | –2 | –10 | –4 | 8 |
| Barley[c] | –6 | –6 | 1 | 5 |
| Canola[d] | –21 | 0 | 2 | 4 |
| Beef[e] | –5 | 6 | –1 | 2 |
| Pork[f] | –7 | 11 | –5 | 0.5 |
| Chicken[g] | –9 | 1.4 | –4 | 4.5 |
| Turkeys[g] | –4 | –2 | 2 | 4 |
| Eggs[h] | –4.5 | –5.6 | 2 | 4 |
| Industrial milk[i] | 2.3 | 1.7 | 1 | 3 |
| Average farm price[j] | –5 | 0.4 | –1.4 | 3 |

[a] Mean of forecast range
[b] 1 CWRS, Thunder Bay (Crop Year)
[c] 1 Fd WCE Thunder Bay (Crop Year)
[d] 1 Vancouver (Crop Year)
[e] A 1/2, Toronto
[f] Index 100, Toronto
[g] Live broiler, Toronto
[h] Large, producer
[i] Target Returns formula
[j] Farm product price index

## FIGURE 1. IMPACT OF U.S. FARM BILL ON CANADIAN BARLEY PRICES, 1986–87 TO 1990–91



# FARM INCOME OUTLOOK[1]

*B.B. Perkins*

## INTRODUCTION

The purpose of this paper is twofold. The first is to provide an overview of the farm income forecasts for 1985 and 1986 along with a look at the medium-term income outlook for Canadian agriculture. The second is to examine the implications of this scenario with respect to the financial health of the industry. Growing evidence of financial difficulties has raised concerns over the prospects for financial recovery.

Let me begin by acknowledging the invaluable assistance of the Agriculture and Natural Resources Division of Statistics Canada and of Provincial Ministries of Agriculture in the preparation of the farm income forecasts. A number of officials have devoted their time unsparingly to complete these estimates. I should also note that a second farm income presentation dealing with the outlook by province is scheduled for the concurrent session of Farm Costs and Income tomorrow morning (see appendix for provincial farm income tables).

It is perhaps useful to review the basic concepts employed in the construction of the farm income estimates. Farm cash receipts cover payments to farmers for the sale of farm products, including government program payments, net cash advances on farm-stored grains and the net difference in deferred grain tickets and ticket liquidations. These receipts do not cover direct sales among farmers within the same province. Farm operating expenses and depreciation charges include all cash costs incurred by farmers in the operation of the farm business plus an allowance for depreciation of farm machinery and buildings. As with receipts, inter-farm sales are excluded. The difference between these two aggregates is realized net income, which includes income-in-kind or the value of farm produce consumer in the farm home. Realized net income is used for debt repayment, reinvestment in the farm, family consumption and savings.

## 1985 FARM INCOME SITUATION

In 1985 realized net farm income is estimated to be lower than in 1984 (Table 1). Despite large stabilization and drought assistance payments, realized net farm income in 1985 is expected to decline about 14% to $3.7 billion from the 1984 estimate of $4.3 billion. However, it should be noted that the relatively high level of farm income in 1984 was due not to a recovery in the farm sector, but rather to the liquidation of grain inventories, cattle herd reduction, large federal and provincial program payments, and drought-induced crop insurance claims.

## FARM CASH RECEIPTS

Total farm cash receipts, including supplementary payments, are expected to decrease by about 3% from $20.3 billion in 1984 to $19.7 billion in 1985. This decrease is due mainly to a substantial reduction in grain receipts which is a result of low farm stocks, and a second consecutive year of reduced volume and poor quality harvest in the Prairies. In particular, wheat receipts in 1985 are forecast to decrease more than 32% and barley receipts are expected to decline 21%. Other major declines in crop receipts include a 58% drop for tobacco and an 11% reduction for potatoes.

The reduction in total crop receipts is largely offset by crop insurance and Western Grain Stabilization payments, estimated at $1.1 billion, so that the overall decline should be limited to about 7%.

In the livestock sector, prospects are a little more favourable, although total livestock receipts are also forecast to decrease slightly this year.

Cattle and calf receipts should increase marginally because of a moderate increase in marketings, due in part to the 1984 and 1985 droughts in western Canada, which resulted in the increased liquidation of the beef cow and calf herds. For hogs, a substantial drop in prices is expected to reduce receipts more than 5%. Receipts from dairy products are forecast to increase slightly, despite cuts in quota and production. By contrast poultry and egg price declines, due to lower feed prices are expected to slightly lower poultry and egg receipts, despite higher marketings. Overall livestock cash receipts will probably decline about one percent.

## FARM EXPENSES

Farm operating expenses and depreciation charges, estimated at $16.3 billion for 1985, remain essentially at the 1984 level. Since 1982 the growth in farm expenditures has been well below the general rate of inflation in the Canadian economy; a sharp contrast to the annual increases of 10 to 20% recorded throughout the 1970's. Feed expenses and interest payments, which have historically accounted for more than 30% of total operating expenses, are forecast to decrease sharply. Lower interest rates and feed grain prices are the key factors. Most other operating expenses are expected to increase between 2 and 6%. Fertilizer expenditures are approximately 6% higher mainly because of an increase in crop area and application rates. Total machinery expenses are forecast to increase by 5%, due to higher fuel costs, machinery repairs and related costs.

Depreciation charges on machinery and buildings are expected to be slightly lower in 1985 relative to 1984 because of reduced levels of investment in recent years.

## 1986 FARM INCOME OUTLOOK

For 1986 realized net farm income is expected to increase 8.6% to $4.05 billion based on a forecast marginal increase in cash receipts and marginal decrease in operating expenses (Table 2). This outlook incorporates the farm commodity, farm input and general economic forecasts being presented at this Conference.

## FARM CASH RECEIPTS

Total farm cash receipts for 1986 are forecast to increase by less than 1%. This change comprises a 1% increase in crop receipts, a 2% increase in livestock receipts, and a 26% decline in other cash receipts. Other cash receipts which generally account for less than 5% of the total cash receipts, include receipts from the sale of forest and maple products as well as dairy supplementary payments, deficiency payments, income stabilization and other supplementary payments made by the federal and provincial governments. This forecast, of course, does not take into account neither disasters such as another major drought nor the benefits of new programs which may be developed in response.

Crop receipts from wheat, oats and barley are expected to increase about 5% in 1986, despite lower forecast prices because of late harvesting and marketing of the 1985 crop in the west, and an assumed return to normal crop conditions and deliveries next year. For oilseeds, current prospects suggest a moderate decrease of about 3% from 1985 receipts, mainly due to depressed world prices. Cash receipts for corn are expected to be down by more than 11% as a result of lower prices and reduced production. On the positive side, horticulture and special crops receipts are expected to increase moderately and a WGSA payout in 1986 will be triggered for the 1985–86 crop year. Cash receipts from sales of potatoes, tobacco, fruits, vegetables, green–house and nursery products are all expected to increase as both prices and sales are forecast to improve through the marketing season.

Cash receipts from sales of livestock and livestock products should attain a record high level of approximately $9.9 billion for 1986. Cattle and calf receipts are expected to increase only marginally, due to higher prices, since cattle and calf production for 1986 is forecast to drop about 5%. But for hogs, an increase in slaughter levels, combined with a continued recovery in farm prices, leads to a forecast increase of approximately 8% in receipts in 1986. Dairy receipts should increase slightly as the expected increase in net target return offsets the forecast decrease in consumption. Chicken and turkey production and prices are expected to increase, raising poultry receipts by about 5%. A forecast decrease in consumption and lower prices, due to lower feed prices and interest rates, suggest a decrease of about 3% in 1986 egg receipts.

## FARM EXPENSES

Current prospects for input price inflation and 1986 farm production levels indicate that total farm operating expenses and depreciation charges will decline for the first time since 1957. A marginal decline of slightly more than 1% to $16.0 billion is forecast. This decrease in farm operating expenses is mainly due to expected decreases in fuel and feed costs and interest payments. Feed prices should continue to decline in 1986 from the levels which are prevalent this winter.

Fuel prices and consumption are forecast to increase at moderate rates for almost every

province but fuel expenses are expected to decrease by about 6% in total after accounting for recently announced fuel assistance programs in Saskatchewan, Alberta and British Columbia. Total interest expenses are forecast to decline about 10% reflecting the continuing drop in interest rates and modest increases in total farm debt. These three major expense items – feed, fuel and interest payments are expected to decrease by more than 7% in 1986. This will more than offset the forecast increases of between 2 to 6% for other expense items such as fertilizers and agricultural chemicals.

## MEDIUM–TERM INCOME PROSPECTS

Turning to the medium–term farm income prospects, I should first make clear that the assessment reflects the expected market conditions as presented by my colleague, Dr. Bruce Huff, and is based on what appears the most probable economic scenario.

Briefly, while some improvement in the Canadian agricultural economy is likely during the remainder of the decade, prospects for significant income gains appear weak. With 50% of its receipts derived from export markets, the prosperity of Canadian agriculture is highly dependent on international markets. Worldwide surplus stocks and excess production capacity will continue to exert downward pressure on farm prices. Export market potential is limited by rising levels of production in some importing countries and balance of payments problems and credit restrictions in others, as well as by the measures taken by exporting countries to enhance their market share or dispose of surpluses. Agricultural policy shifts in other countries, particularly in the United States and the European Economic Community, together with currency fluctuations, interest rate changes and other internationally determined factors will exert dominating influences on the recovery and stability of Canadian agriculture.

Towards the end of the decade, prospects become more favorable in the crop sector as United States acreage reduction programs are expected to reduce stocks and strengthen international prices, generating significant gains in total cash receipts for Canadian farmers. The average for the 1985–90 period, however, is a modest annual growth rate of 3.4% in cash receipts (Table 3). Declining interest rates and low input price inflation are expected to limit the annual rise in farm expenses to less than the general inflation rate of 3 to 5%.

Consequently, realized net farm income should rise slowly over the period with the timing of significant improvements depending upon a rebound in crop prices. Such a scenario would result in an annual growth rate of about 2.5% for the 1985–90 period, or slightly below the general inflation rate. The implication is that over the medium–term, the industry will continue to experience financial difficulties in the form of debt servicing problems, depressed investment and declining equity. I would now like to briefly examine the possible nature and extent of these difficulties.

## FARM INCOME IMPLICATIONS

Let me start by saying net income, by itself, is not an adequate measure of an industry's financial performance over time. The most serious weakness is that net income is an indication of current returns to a number of different resources including management, unpaid family labor and equity capital; the level and combination of which are constantly changing (Table 4). It is clear that production and financial management requirements have increased with average farm size and the greater complexity of modern agriculture. Replacement of unpaid family labor with hired workers and the continued substitution of capital for labor have also changed the composition of these productive resources. The level of capital input, for example, has increased 45% since 1971 while the input of unpaid family and operator labor has decreased 28%.

Another weakness of net income as a measure of financial performance is that it does not recognize economic returns in the form of capital gain or loss. Thus other measures are necessary to examine the financial implications of the current farm income outlook. I propose to look at three measures; debt servicing ability, returns to assets and equity.

## DEBT SERVICING ABILITY

The most immediate farm financial problem is the declining ability of an increasing number of farmers to meet their debt repayment commitments. Faced with depressed incomes,

large debt loads and high interest rates, many farmers have been unable to service their annual interest charges and principal payments. This has led to extensive refinancing, increased loan arrears and, in severe cases, the initiation of foreclosure actions. The farm Credit Corporation, for example, which has a large number of highly-leveraged clients, reports the number of accounts in arrears is up 20% over year earlier levels with the dollar amount of funds in arrears up 50%. Debt servicing ability does not lend itself well to aggregate analysis: it is really a matter of the distribution of farm income and debt. However, the root of the current problems becomes evident if one looks at the industry's cash flow in relation to debt servicing requirements (annual principal and interest charges).

Growth in farm cash flow has not kept pace with debt servicing requirements (Table 5). Over the last 15 years, the annual interest and principal payments of the industry have risen much faster than the funds available to farmers to service their debt commitments. For the 1971–75 period, the funds required to service farm debt as a percent of farm cash flow averaged about 22%. In the period 1976–80, this proportion rose to 36% and in the period 1981–85, it rose further to 45%. Moreover, not all of the industry's annual cash flow can be used to service farm debt. It must also service rising levels of family consumption, at least in nominal terms, while sustaining existing levels of productive resources through reinvestment in the farm. Through the seventies many farmers and their creditors used the appreciating value of farmland as collateral to expand their operation through debt financing. A difficult debt servicing situation has developed in the eighties in the absence of further cash flow growth, and in the face of high real interest rates.

Over the next 5 years, the modest improvements in farm income described earlier suggest a gradual strengthening of farm cash flow. In absolute terms debt servicing requirements are expected to remain relatively flat, the result of refinancing measures, little growth in new debt and declining interest rates. In relative terms then debt servicing requirements could fall from the current level of 46% of annual cash flow to close to 40% by 1990 under this scenario. The result would be a modest improvement in the industry's debt servicing ability.

## FARM INVESTMENT

Farm investment is another important indicator of agriculture's economic environment. Annual investment in farm machinery and buildings, in constant 1981 dollars, averaged $3.3 billion for the 1971–75 period, rising by over 40% to $4.6 billion for the 1976–80 period (Table 6). During the 1981–85 period, however, average annual investment declined to $3.9 billion, a decrease of 16%. This sharp drop in farm investment raises long-run concerns about continued productivity growth and competitiveness of the industry while having immediate negative consequences for the agricultural service industries and rural communities in general.

The level of investment in an industry is dependent on the expected rate of return to assets in that industry. Total expected returns to assets consists of the return from the productive use of assets and anticipated returns through asset appreciation (or depreciation) in the form of capital gain (or loss).

During the 1970's, the annual rate of productive return to farm assets fluctuated around 2% while the annual rate of appreciation on farm assets was about 5%. Total returns for the period were strongly positive. Since 1981, productive returns have fallen to 1.4%, on average, with asset depreciation resulting in an average annual capital loss of close to 9%. For the 1981–85 period, then, total returns have been negative and the level of farm investment has dropped accordingly.

For the industry as a whole, a further depreciation in the value of assets is likely in the next five year period as part of the financial restructuring in agriculture. This will serve to keep anticipated total returns for Canadian agriculture down. As a result, investment in agriculture is not expected to begin to recover until later in the eighties. At that point, both improvements in expected rates of return and the need to replace worn out machinery and depreciated buildings should contribute to an upswing in investment.

## FARM ASSET VALUES

Finally, I would like to examine the phenomenon of changing farm asset values, notably land and building asset values. Changes in the value of these assets over and above the rate of inflation

result in increases in the equity of asset owners. From 1971 to 1980, the value of farm land and buildings, in constant dollars, increased by $63 billion; over the next five years, the value of these assets declined by $33 billion. The result has been a substantial decline in farmers' equity or wealth since 1981 and some loss of confidence by creditors in the major assets used by farmers as loan security.

Parenthetically, I should note that most businesses value their assets at the purchase price or book value, and treat changes in the value of assets, when realized through actual sale, as windfall gains. Anticipated changes in asset values are recognized in a kind of shadow accounting in asset transaction decisions. In agriculture, the paucity of balance sheet information together with observation of the long-term tendency of farm land values to appreciate, has led to the emphasis being placed on current market valuation of assets. When such information is used to reach farm financing decisions it can result in serious mistakes, as many who invested in farming in the late seventies have discovered.

The value of farm land and buildings reflects the expected returns that can be generated by these assets. Prices were bid up during the 1970's as income expectations were fueled by relatively high rates of total return. The situation was exacerbated by low, and sometimes negative, real interest rates. Corresponding to a 10% annual growth rate in the value of farm land and buildings for the 1971–80 period, the rate of total return on assets averaged 6.9% while real interest rates averaged only 1.5% (Table 7). It also appears that the expectation of continuing land price increases contributed to the bidding up of prices, so that farm land took on the characteristics of a growth stock.

The substantial reassessment of farm asset values which started in the eighties was brought about by a combination of factors. The rate of return from farm production declined as commodity markets weakened; real interest rates increased sharply; a rising incidence of financial difficulty, particularly among more leveraged farm borrowers, precipitated concern about the future financing of farm businesses; and as declines in farm land prices occurred in a number of regions, confidence in the security of farm land investment receded.

As I noted earlier, some further depreciation of the total value of farm assets is expected in the balance of the decade. Real interest rates are expected to decline but remain high, averaging 4.6%. Productive returns are expected to improve gradually. Better returns and lower interest rates will help, but fundamentally farm asset values need to reach a new equilibrium with expected earnings before a bullish attitude toward farmland investment will reemerge.

Finally, I would be remiss in reviewing the income and finance outlook if I did not stress the diversity of situations and prospects within the farm sector. In focussing as I have done on the totals and averages for the sector it is easy to lose sight of the fact that the great majority of farm businesses are in good financial health while others face varying degrees of financial difficulty. For farming as a sector, the eighties is a decade of structural adjustment in which the focus is on reduced debt financing, considerable investment caution, and a general strengthening of financial management.

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[1] This paper has been revised from that presented at the Outlook Conference to incorporate more recent information.

## TABLE 1. 1985 FARM INCOME FORECAST

| | 1984 | 1985 | Change 1985/84 |
|---|---|---|---|
| | $ millions | | percent |
| Cash receipts | 20 316 | 19 724 | -2.91 |
| Expenses and depreciation | 16 246 | 16 252 | +0.04 |
| Realized net income | 4 334 | 3 731 | -13.91 |

## TABLE 2. 1986 FARM INCOME FORECAST

| | 1985 | 1986 | Change 1985/86 |
|---|---|---|---|
| | $ millions | | percent |
| Cash receipts | 19 724 | 19 828 | +0.53 |
| Expenses and depreciation | 16 252 | 16 039 | -1.31 |
| Realized net income | 3 731 | 4 051 | +8.58 |

## TABLE 3. MEDIUM-TERM INCOME FORECAST

| | Annual growth rate | |
|---|---|---|
| | 1980–85 | 1985–90 |
| percent | | |
| Cash receipts | +4.4 | +3.4 |
| Expenses and depreciation | +4.8 | +3.5 |
| Realized net income | +2.4 | +2.5 |
| Realized net income (1981 $) | -3.9 | -2.0 |

TABLE 4.

| Year | Farm capital[a] | Unpaid family labour[b] |
|---|---|---|
| | million 1981 $ | million hours |
| 1971 | 89 741 | 1 003 |
| 1972 | 94 533 | 930 |
| 1973 | 97 862 | 924 |
| 1974 | 102 312 | 942 |
| 1975 | 104 079 | 923 |
| 1976 | 108 459 | 868 |
| 1977 | 114 690 | 825 |
| 1978 | 119 406 | 860 |
| 1979 | 124 830 | 857 |
| 1980 | 128 800 | 875 |
| 1981 | 130 397 | 816 |
| 1982 | 129 687 | 770 |
| 1983 | 129 054 | 756 |
| 1984 | 128 475 | 742 |
| 1985 | 129 354 | 727 |

[a] Estimated value of land and buildings, machinery and equipment, and livestock and poultry deflated by the appropriate farm input price indexes. The total values therefore approximate the physical level of capital used on farms.
[b] Includes the total non-wage labour provided by the farm operator and his family.

TABLE 5.

| Year | Cash flow | Debt servicing requirements | |
|---|---|---|---|
| | $ million | $ million | percent of cash flow |
| 1971 | 1 974 | 534 | 27.1 |
| 1972 | 2 679 | 567 | 21.2 |
| 1973 | 3 453 | 746 | 21.6 |
| 1974 | 4 726 | 949 | 20.1 |
| 1975 | 5 284 | 1 133 | 21.4 |
| 1976 | 4 840 | 1 403 | 29.0 |
| 1977 | 4 476 | 1 614 | 36.1 |
| 1978 | 5 505 | 1 974 | 35.9 |
| 1979 | 6 614 | 2 453 | 37.1 |
| 1980 | 7 018 | 2 977 | 42.4 |
| 1981 | 8 654 | 4 005 | 46.3 |
| 1982 | 8 169 | 4 070 | 49.8 |
| 1983 | 7 644 | 3 633 | 47.5 |
| 1984 | 8 767 | 3 956 | 45.1 |
| 1985 | 7 852 | 3 620 | 46.1 |
| 1986 | 8 128 | 3 546 | 43.6 |
| 1987 | 8 149 | 3 683 | 45.2 |
| 1988 | 8 251 | 3 655 | 44.3 |
| 1989 | 8 555 | 3 660 | 42.8 |
| 1990 | 9 219 | 3 737 | 40.5 |

TABLE 6.

| Year | Investment | Rate of total return to assets |
|---|---|---|
| | million 1981 $ | % |
| 1971 | 2 240 | -4.63 |
| 1972 | 2 758 | 3.00 |
| 1973 | 3 415 | 12.74 |
| 1974 | 3 803 | 12.32 |
| 1975 | 4 250 | 9.23 |
| 1976 | 4 523 | 6.98 |
| 1977 | 4 427 | 2.14 |
| 1978 | 4 602 | 8.05 |
| 1979 | 5 047 | 10.60 |
| 1980 | 4 629 | 8.89 |
| 1981 | 4 719 | 0.19 |
| 1982 | 3 975 | -9.96 |
| 1983 | 3 584 | -10.29 |
| 1984 | 3 643 | -7.62 |
| 1985 | 3 617 | -9.41 |
| 1986 | 3 636 | -8.06 |
| 1987 | 3 378 | -5.47 |
| 1988 | 3 282 | -4.86 |
| 1989 | 3 235 | -3.21 |
| 1990 | 3 251 | 0.59 |

TABLE 7.

| Period | Annual growth rate in real value of farm land and buildings | Average rate of total return to assets | Average real interest rate |
|---|---|---|---|
| 1971–80 | +10.6 | +6.9 | +1.5 |
| 1981–85 | -7.1 | -7.4 | +6.3 |
| 1986–90 | -2.6 | -4.2 | +4.6 |

# FARM INCOME APPENDIX

## TABLE 1. FARM CASH RECEIPTS, 1984 TO 1986, CANADA

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Wheat[1,4] | 4 191 700 | 3 111 006 | |
| Oats[1] | 65 335 | 51 156 | |
| Barley[1] | 690 842 | 669 433 | |
| Crop ins, advances deferments, & WGSA[2] | 673 008 | 1 306 940 | |
| Rye | 55 889 | 27 196 | |
| Flaxseed | 156 015 | 176 829 | |
| Canola/rapeseed | 934 779 | 864 700 | |
| Soybeans | 205 169 | 229 286 | |
| Corn | 567 758 | 546 087 | |
| Sugar beets | 31 264 | 12 536 | |
| Potatoes | 311 131 | 275 951 | |
| Fruits | 260 362 | 263 971 | |
| Vegetables | 523 878 | 544 275 | |
| Tobacco | 379 646 | 160 068 | |
| Other crops[5] | 764 585 | 861 335 | |
| Total crops | 9 811 361 | 9 100 768 | 9 230 097 |
| Cattle and calves | 3 557 738 | 3 565 272 | |
| Hogs | 1 888 483 | 1 782 615 | |
| Sheep and lambs | 27 970 | 28 695 | |
| Dairy products | 2 707 717 | 2 731 695 | |
| Poultry | 889 292 | 887 769 | |
| Eggs | 505 980 | 486 876 | |
| Other livestock | 190 887 | 183 539 | |
| Total livestock | 9 768 067 | 9 666 461 | 9 889 190 |
| Other cash receipts[3] | 736 319 | 956 849 | 708 568 |
| Total cash receipts | 20 315 747 | 19 724 078 | 19 827 855 |

## TABLE 1A. FARM OPERATING EXPENSES AND DEPRECIATION CHARGES, 1984 TO 1986, CANADA

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Taxes[a] | 271 400 | 301 531 | |
| Gross farm rent | 683 692 | 676 470 | |
| Wages to farm labour | 1 289 615 | 1 354 099 | |
| Interest on indebtedness[b] | 1 974 773 | 1 844 826 | |
| Total machinery expenses[c] | 2 382 007 | 2 498 783 | |
| Fertilizer and lime | 1 343 108 | 1 420 726 | |
| Other crop expenses[d] | 1 116 370 | 1 160 584 | |
| Feed[e] | 2 144 155 | 1 974 483 | |
| Other livestock expenses[f] | 589 184 | 571 295 | |
| Repairs to buildings[g] | 259 354 | 262 853 | |
| Electricity and telephone | 355 009 | 372 500 | |
| Miscellaneous[g] | 1 127 859 | 1 184 124 | |
| Total operating expenses | 13 536 526 | 13 622 274 | 13 415 390 |
| Depreciation on buildings | 482 109 | 459 936 | 432 340 |
| Depreciation on machinery | 2 227 128 | 2 169 305 | 2 190 997 |
| Total operating expenses and depreciation charges | 16 245 763 | 16 251 515 | 16 038 727 |
| *Income of farm operators from farming operations* | | | |
| Cash receipts | 20 315 747 | 19 724 078 | 19 827 855 |
| Income-in-kind[h] | 264 014 | 258 437 | 261 851 |
| Realized gross income (1 + 2) | 20 579 761 | 19 982 515 | 20 089 706 |
| Operating & dep. charges | 16 245 763 | 16 251 515 | 16 038 727 |
| Realized net income (3–4) | 4 333 998 | 3 731 000 | 4 050 979 |
| Value of inventory changes | -950 018 | 541 157 | |
| Total net income (5 + 6) | 3 383 980 | 4 272 157 | |

See footnote(s) at end of tables.

## TABLE 2. FARM CASH RECEIPTS, 1984 TO 1986, NEWFOUNDLAND

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Wheat[1,4] | – | – | |
| Oats[1] | – | – | |
| Barley[1] | – | – | |
| Crop ins, advances deferments, & WGSA[2] | 4 | 2 | |
| Rye | – | – | |
| Flaxseed | – | – | |
| Canola/rapeseed | – | – | |
| Soybeans | – | – | |
| Corn | – | – | |
| Sugar beets | – | – | |
| Potatoes | 942 | 925 | |
| Fruits | 536 | 491 | |
| Vegetables | 2 190 | 1 564 | |
| Tobacco | – | – | |
| Other crops[5] | 2 023 | 2 077 | |
| Total crops | 5 695 | 5 059 | 5 201 |
| Cattle and calves | 1 597 | 1 616 | |
| Hogs | 4 680 | 4 062 | |
| Sheep and lambs | 123 | 139 | |
| Dairy products | 8 534 | 9 818 | |
| Poultry | 10 540 | 11 037 | |
| Eggs | 9 275 | 8 970 | |
| Other livestock | 721 | 845 | |
| Total livestock | 35 470 | 36 487 | 37 801 |
| Other cash receipts[3] | 320 | 137 | 234 |
| Total cash receipts | 41 485 | 41 683 | 43 236 |

## TABLE 2A. FARM OPERATING EXPENSES AND DEPRECIATION CHARGES, 1984 TO 1986, NEWFOUNDLAND

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Taxes[a] | 30 | 31 | |
| Gross farm rent | 139 | 139 | |
| Wages to farm labour | 4 468 | 4 794 | |
| Interest on indebtedness[b] | 1 498 | 1 600 | |
| Total machinery expenses[c] | 2 408 | 2 531 | |
| Fertilizer and lime | 1 129 | 1 176 | |
| Other crop expenses[d] | 817 | 822 | |
| Feed[e] | 14 797 | 14 960 | |
| Other livestock expenses[f] | 696 | 1 116 | |
| Repairs to buildings[g] | 412 | 432 | |
| Electricity and telephone | 863 | 1 013 | |
| Miscellaneous[g] | 1 839 | 1 930 | |
| Total operating expenses | 29 096 | 30 544 | 30 632 |
| Depreciation on buildings | 640 | 611 | 574 |
| Depreciation on machinery | 1 282 | 1 282 | 1 295 |
| Total operating expenses and depreciation charges | 31 018 | 32 437 | 32 501 |
| *Income of farm operators from farming operations* | | | |
| Cash receipts | 41 485 | 41 683 | 43 236 |
| Income-in-kind[h] | 516 | 621 | 641 |
| Realized gross income (1 + 2) | 42 001 | 42 304 | 43 877 |
| Operating & dep. charges | 31 018 | 32 437 | 32 501 |
| Realized net income (3–4) | 10 983 | 9 867 | 11 376 |
| Value of inventory changes | 541 | -236 | |
| Total net income (5 + 6) | 11 524 | 9 631 | |

See footnote(s) at end of tables.

## TABLE 3. FARM CASH RECEIPTS, 1984 TO 1986, PRINCE EDWARD ISLAND

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Wheat[1,4] | 468 | 481 | |
| Oats[1] | 572 | 505 | |
| Barley[1] | 2 382 | 2 887 | |
| Crop ins, advances deferments, & WGSA[2] | 3 093 | 1 500 | |
| Rye | - | - | |
| Flaxseed | - | - | |
| Canola/rapeseed | - | - | |
| Soybeans | - | - | |
| Corn | - | - | |
| Sugar beets | - | - | |
| Potatoes | 72 105 | 59 779 | |
| Fruits | 1 432 | 1 763 | |
| Vegetables | 5 391 | 4 868 | |
| Tobacco | 13 096 | 12 106 | |
| Other crops[5] | 3 256 | 4 475 | |
| Total crops | 101 795 | 88 364 | 87 596 |
| Cattle and calves | 24 131 | 24 161 | |
| Hogs | 22 817 | 21 641 | |
| Sheep and lambs | 225 | 262 | |
| Dairy products | 28 708 | 30 934 | |
| Poultry | 899 | 833 | |
| Eggs | 2 985 | 2 899 | |
| Other livestock | 2 869 | 3 111 | |
| Total livestock | 82 634 | 83 841 | 91 084 |
| Other cash receipts[3] | 8 137 | 9 142 | 8 545 |
| Total cash receipts | 192 566 | 181 347 | 187 225 |

## TABLE 3A. FARM OPERATING EXPENSES AND DEPRECIATION CHARGES, 1984 TO 1986, PRINCE EDWARD ISLAND

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Taxes[a] | 1 451 | 1 509 | |
| Gross farm rent | 3 169 | 3 010 | |
| Wages to farm labour | 17 728 | 19 020 | |
| Interest on indebtedness[b] | 13 711 | 12 975 | |
| Total machinery expenses[c] | 22 510 | 24 547 | |
| Fertilizer and lime | 15 526 | 17 078 | |
| Other crop expenses[d] | 11 306 | 11 637 | |
| Feed[e] | 18 665 | 18 740 | |
| Other livestock expenses[f] | 4 989 | 5 195 | |
| Repairs to buildings[g] | 2 765 | 2 923 | |
| Electricity and telephone | 4 196 | 4 315 | |
| Miscellaneous[g] | 8 850 | 9 260 | |
| Total operating expenses | 124 866 | 130 209 | 130 456 |
| Depreciation on buildings | 2 907 | 2 774 | 2 608 |
| Depreciation on machinery | 15 446 | 15 370 | 15 524 |
| Total operating expenses and depreciation charges | 143 219 | 148 353 | 148 588 |
| *Income of farm operators from farming operations* | | | |
| Cash receipts | 192 566 | 181 347 | 187 225 |
| Income-in-kind[h] | 2 961 | 2 781 | 2 810 |
| Realized gross income (1 + 2) | 195 527 | 184 128 | 190 035 |
| Operating & dep. charges | 143 219 | 148 353 | 148 588 |
| Realized net income (3–4) | 52 308 | 35 775 | 41 447 |
| Value of inventory changes | 14 280 | -14 036 | |
| Total net income (5 + 6) | 66 588 | 21 739 | |

See footnote(s) at end of tables.

## TABLE 4. FARM CASH RECEIPTS, 1984 TO 1986, NOVA SCOTIA

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Wheat[1,4] | 811 | 622 | |
| Oats[1] | 249 | 249 | |
| Barley[1] | 211 | 193 | |
| Crop ins, advances deferments, & WGSA[2] | 165 | 500 | |
| Rye | – | – | |
| Flaxseed | – | – | |
| Canola/rapeseed | – | – | |
| Soybeans | – | – | |
| Corn | – | – | |
| Sugar beets | – | – | |
| Potatoes | 4 539 | 4 724 | |
| Fruits | 19 251 | 18 978 | |
| Vegetables | 8 180 | 9 492 | |
| Tobacco | 2 640 | 2 447 | |
| Other crops[5] | 13 645 | 13 339 | |
| Total crops | 49 691 | 50 544 | 51 123 |
| Cattle and calves | 23 791 | 26 634 | |
| Hogs | 31 536 | 29 986 | |
| Sheep and lambs | 1 419 | 1 478 | |
| Dairy products | 73 884 | 77 135 | |
| Poultry | 29 351 | 28 155 | |
| Eggs | 19 294 | 19 502 | |
| Other livestock | 11 713 | 11 824 | |
| Total livestock | 190 998 | 194 714 | 202 062 |
| Other cash receipts[3] | 15 833 | 13 999 | 12 534 |
| Total cash receipts | 256 512 | 259 257 | 265 719 |

## TABLE 4A. FARM OPERATING EXPENSES AND DEPRECIATION CHARGES, 1984 TO 1986, NOVA SCOTIA

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Taxes[a] | 2 093 | 2 177 | |
| Gross farm rent | 1 622 | 1 591 | |
| Wages to farm labour | 30 452 | 32 668 | |
| Interest on indebtedness[b] | 14 776 | 14 480 | |
| Total machinery expenses[c] | 24 085 | 25 422 | |
| Fertilizer and lime | 8 226 | 8 218 | |
| Other crop expenses[d] | 9 149 | 8 941 | |
| Feed[e] | 62 694 | 57 616 | |
| Other livestock expenses[f] | 4 030 | 4 444 | |
| Repairs to buildings[a] | 4 441 | 4 654 | |
| Electricity and telephone | 5 251 | 5 251 | |
| Miscellaneous[g] | 11 173 | 11 441 | |
| Total operating expenses | 177 992 | 176 903 | 176 288 |
| Depreciation on buildings | 7 112 | 6 786 | 6 379 |
| Depreciation on machinery | 15 830 | 15 462 | 15 617 |
| Total operating expenses and depreciation charges | 200 934 | 199 151 | 198 284 |
| *Income of farm operators from farming operations* | | | |
| Cash receipts | 256 512 | 259 257 | 265 719 |
| Income-in-kind[h] | 6 151 | 6 152 | 6 255 |
| Realized gross income (1 + 2) | 262 663 | 265 409 | 271 974 |
| Operating & dep. charges | 200 934 | 199 151 | 198 284 |
| Realized net income (3–4) | 61 729 | 66 258 | 73 690 |
| Value of inventory changes | 845 | –1 879 | |
| Total net income (5 + 6) | 62 574 | 64 380 | |

See footnote(s) at end of tables.

## TABLE 5. FARM CASH RECEIPTS, 1984 TO 1986, NEW BRUNSWICK

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Wheat[1,4] | 512 | 659 | |
| Oats[1] | 1 226 | 1 478 | |
| Barley[1] | 586 | 845 | |
| Crop ins, advances deferments, & WGSA[2] | 2 707 | 3 500 | |
| Rye | – | – | |
| Flaxseed | – | – | |
| Canola/rapeseed | – | – | |
| Soybeans | – | – | |
| Corn | – | – | |
| Sugar beets | – | – | |
| Potatoes | 52 229 | 46 447 | |
| Fruits | 4 301 | 5 163 | |
| Vegetables | 7 886 | 8 689 | |
| Tobacco | 1 548 | 1 428 | |
| Other crops[5] | 13 239 | 8 471 | |
| Total crops | 84 234 | 76 680 | 78 248 |
| Cattle and calves | 21 123 | 19 711 | |
| Hogs | 21 902 | 20 705 | |
| Sheep and lambs | 326 | 325 | |
| Dairy products | 50 492 | 52 256 | |
| Poultry | 21 464 | 21 978 | |
| Eggs | 13 385 | 13 339 | |
| Other livestock | 3 736 | 3 852 | |
| Total livestock | 132 428 | 132 166 | 138 306 |
| Other cash receipts[3] | 11 257 | 11 696 | 11 147 |
| Total cash receipts | 227 919 | 220 542 | 227 701 |

## TABLE 5A. FARM OPERATING EXPENSES AND DEPRECIATION CHARGES, 1984 TO 1986, NEW BRUNSWICK

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Taxes[a] | 2 211 | 2 299 | |
| Gross farm rent | 1 057 | 1 025 | |
| Wages to farm labour | 21 406 | 22 967 | |
| Interest on indebtedness[b] | 17 488 | 17 612 | |
| Total machinery expenses[c] | 27 091 | 28 266 | |
| Fertilizer and lime | 13 393 | 14 036 | |
| Other crop expenses[d] | 10 694 | 10 742 | |
| Feed[e] | 41 807 | 39 424 | |
| Other livestock expenses[f] | 3 115 | 2 960 | |
| Repairs to buildings[a] | 3 618 | 3 857 | |
| Electricity and telephone | 4 301 | 4 497 | |
| Miscellaneous[g] | 7 247 | 7 499 | |
| Total operating expenses | 153 428 | 155 184 | 154 641 |
| Depreciation on buildings | 3 680 | 3 510 | 3 299 |
| Depreciation on machinery | 14 840 | 15 048 | 15 198 |
| Total operating expenses and depreciation charges | 171 948 | 173 742 | 173 138 |
| *Income of farm operators from farming operations* | | | |
| Cash receipts | 227 919 | 220 542 | 227 701 |
| Income-in-kind[h] | 4 091 | 3 875 | 3 929 |
| Realized gross income (1 + 2) | 232 010 | 224 417 | 231 630 |
| Operating & dep. charges | 171 948 | 173 742 | 173 138 |
| Realized net income (3–4) | 60 062 | 50 675 | 58 492 |
| Value of inventory changes | 6 202 | 1 632 | |
| Total net income (5 + 6) | 66 264 | 52 307 | |

See footnote(s) at end of tables.

## TABLE 6. FARM CASH RECEIPTS, 1984 TO 1986, QUEBEC

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Wheat[1,4] | 10 962 | 14 489 | |
| Oats[1] | 17 494 | 18 233 | |
| Barley[1] | 24 066 | 27 137 | |
| Crop ins, advances deferments, & WGSA[2] | 17 089 | 6 500 | |
| Rye | – | – | |
| Flaxseed | – | – | |
| Canola/rapeseed | – | – | |
| Soybeans | – | – | |
| Corn | 142 241 | 148 976 | |
| Sugar beets | 1 762 | 922 | |
| Potatoes | 48 398 | 35 721 | |
| Fruits | 35 306 | 44 066 | |
| Vegetables | 93 966 | 97 087 | |
| Tobacco | 26 379 | 26 638 | |
| Other crops[5] | 75 722 | 81 105 | |
| Total crops | 493 385 | 500 874 | 512 352 |
| Cattle and calves | 276 581 | 274 676 | |
| Hogs | 596 345 | 550 059 | |
| Sheep and lambs | 4 295 | 4 600 | |
| Dairy products | 998 378 | 993 370 | |
| Poultry | 251 733 | 260 803 | |
| Eggs | 86 333 | 83 363 | |
| Other livestock | 34 378 | 32 564 | |
| Total livestock | 2 248 043 | 2 199 435 | 2 276 515 |
| Other cash receipts[3] | 311 757 | 302 877 | 287 504 |
| Total cash receipts | 3 053 185 | 3 003 186 | 3 076 371 |

## TABLE 6A. FARM OPERATING EXPENSES AND DEPRECIATION CHARGES, 1984 TO 1986, QUEBEC

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Taxes[a] | 38 320 | 39 853 | |
| Gross farm rent | 21 053 | 21 024 | |
| Wages to farm labour | 210 527 | 224 577 | |
| Interest on indebtedness[b] | 247 425 | 240 117 | |
| Total machinery expenses[c] | 251 304 | 263 277 | |
| Fertilizer and lime | 156 705 | 154 041 | |
| Other crop expenses[d] | 130 440 | 130 966 | |
| Feed[e] | 667 678 | 606 919 | |
| Other livestock expenses[f] | 64 157 | 74 012 | |
| Repairs to buildings[g] | 52 758 | 53 602 | |
| Electricity and telephone | 66 829 | 68 068 | |
| Miscellaneous[g] | 153 890 | 156 775 | |
| Total operating expenses | 2 061 086 | 2 033 231 | 2 016 325 |
| Depreciation on buildings | 65 745 | 62 720 | 58 957 |
| Depreciation on machinery | 194 130 | 189 343 | 191 236 |
| Total operating expenses and depreciation charges | 2 320 961 | 2 285 294 | 2 266 518 |
| *Income of farm operators from farming operations* | | | |
| Cash receipts | 3 053 185 | 3 003 186 | 3 076 371 |
| Income-in-kind[h] | 58 415 | 58 514 | 59 695 |
| Realized gross income (1 + 2) | 3 111 600 | 3 061 700 | 3 136 066 |
| Operating & dep. charges | 2 320 961 | 2 285 294 | 2 266 518 |
| Realized net income (3–4) | 790 639 | 776 406 | 869 548 |
| Value of inventory changes | 8 795 | 27 620 | |
| Total net income (5 + 6) | 799 434 | 804 026 | |

See footnote(s) at end of tables.

## TABLE 7. FARM CASH RECEIPTS, 1984 TO 1986 Ontario

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Wheat[1,4] | 111 715 | 137 470 | |
| Oats[1] | 2 182 | 2 320 | |
| Barley[1] | 15 916 | 16 521 | |
| Crop ins., advances deferments, & WGSA[2] | 18 275 | 20 000 | |
| Rye | | 841 | 798 |
| Flaxseed | – | – | |
| Canola/Rapeseed | – | – | |
| Soybeans | 205 169 | 229 286 | |
| Corn | 403 781 | 377 213 | |
| Sugar beets | – | – | |
| Potatoes | 50 578 | 40 449 | |
| Fruits | 112 580 | 112 577 | |
| Vegetables | 303 534 | 308 274 | |
| Tobacco | 335 983 | 117 449 | |
| Other crops[5] | 364 742 | 484 196 | |
| Total crops | 1 925 296 | 1 846 553 | 1 953 174 |
| Cattle and calves | 1 095 364 | 1 073 719 | |
| Hogs | 625 809 | 575 602 | |
| Sheep and lambs | 10 800 | 10 363 | |
| Dairy products | 912 803 | 928 476 | |
| Poultry | 317 421 | 323 972 | |
| Eggs | 198 482 | 190 164 | |
| Other livestock | 53 009 | 53 192 | |
| Total livestock | 3 213 688 | 3 155 488 | 3 276 193 |
| Other cash receipts[3] | 198 063 | 115 037 | 141 056 |
| Total cash receipts | 5 337 047 | 5 117 078 | 5 370 423 |

## TABLE 7A. FARM OPERATING EXPENSES AND DEPRECIATION CHARGES, 1984 TO 1986, ONTARIO

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Taxes[a] | 45 078 | 48 233 | |
| Gross farm rent | 111 498 | 110 996 | |
| Wages to farm labour | 422 572 | 456 988 | |
| Interest on indebtedness[b] | 502 013 | 457 806 | |
| Total machinery expenses[c] | 455 452 | 481 948 | |
| Fertilizer and lime | 274 613 | 282 306 | |
| Other crop expenses[d] | 293 004 | 290 396 | |
| Feed[e] | 723 756 | 653 552 | |
| Other livestock expenses[f] | 297 635 | 312 715 | |
| Repairs to buildings[g] | 79 223 | 81 758 | |
| Electricity and telephone | 100 656 | 109 817 | |
| Miscellaneous[g] | 334 091 | 342 921 | |
| Total operating expenses | 3 639 591 | 3 629 436 | 3 588 476 |
| Depreciation on buildings | 182 946 | 174 531 | 164 059 |
| Depreciation on machinery | 443 451 | 439 927 | 444 326 |
| Total operating expenses and depreciation charges | 4 265 988 | 4 243 894 | 4 196 861 |
| *Income of farm operators from farming operations* | | | |
| Cash receipts | 5 337 047 | 5 117 078 | 5 370 423 |
| Income-in-kind[h] | 70 004 | 66 886 | 68 480 |
| Realized gross income (1 + 2) | 5 407 051 | 5 183 964 | 5 438 903 |
| Operating & dep. charges | 4 265 988 | 4 243 894 | 4 196 861 |
| Realized net income (3–4) | 1 141 063 | 940 070 | 1 242 042 |
| Value of inventory changes | 78 317 | 117 740 | |
| Total net income (5 + 6) | 1 219 380 | 1 057 810 | |

See footnote(s) at end of tables.

## TABLE 8. FARM CASH RECEIPTS, 1984 TO 1986, MANITOBA

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Wheat[1,4] | 616 919 | 532 537 | |
| Oats[1] | 8 266 | 7 154 | |
| Barley[1] | 133 926 | 138 116 | |
| Crop ins., advances deferments, & WGSA[2] | 61 425 | 102 529 | |
| Rye | | 14 178 | 8 423 |
| Flaxseed | 95 942 | 104 736 | |
| Canola/Rapeseed | 141 487 | 164 679 | |
| Soybeans | – | – | |
| Corn | 21 736 | 19 898 | |
| Sugar beets | 11 682 | 9 044 | |
| Potatoes | 27 591 | 29 151 | |
| Fruits | – | – | |
| Vegetables | 13 594 | 13 614 | |
| Tobacco | – | – | |
| Other crops[5] | 74 149 | 63 959 | |
| Total crops | 1 220 895 | 1 193 840 | 1 260 665 |
| Cattle and calves | 276 706 | 299 897 | |
| Hogs | 185 740 | 194 893 | |
| Sheep and lambs | 1 552 | 1 542 | |
| Dairy products | 104 926 | 102 330 | |
| Poultry | 47 205 | 45 677 | |
| Eggs | 48 345 | 47 762 | |
| Other livestock | 17 944 | 17 858 | |
| Total livestock | 682 418 | 709 959 | 746 193 |
| Other cash receipts[3] | 39 344 | 31 542 | 35 351 |
| Total cash receipts | 1 942 657 | 1 935 341 | 2 042 209 |

## TABLE 8A. FARM OPERATING EXPENSES AND DEPRECIATION CHARGES, 1984 TO 1986, MANITOBA

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Taxes[a] | 35 112 | 36 516 | |
| Gross farm rent | 94 036 | 92 847 | |
| Wages to farm labour | 75 745 | 78 599 | |
| Interest on indebtedness[b] | 171 430 | 157 647 | |
| Total machinery expenses[c] | 290 405 | 309 518 | |
| Fertilizer and lime | 211 073 | 231 547 | |
| Other crop expenses[d] | 166 924 | 173 881 | |
| Feed[e] | 134 875 | 132 717 | |
| Other livestock expenses[f] | 24 329 | 30 644 | |
| Repairs to buildings[g] | 23 650 | 23 343 | |
| Electricity and telephone | 31 173 | 32 679 | |
| Miscellaneous[g] | 86 421 | 97 719 | |
| Total operating expenses | 1 345 173 | 1 397 657 | 1 415 693 |
| Depreciation on buildings | 18 545 | 17 693 | 16 631 |
| Depreciation on machinery | 258 396 | 242 291 | 244 714 |
| Total operating expenses and depreciation charges | 1 622 114 | 1 657 641 | 1 677 038 |
| *Income of farm operators from farming operations* | | | |
| Cash receipts | 1 942 657 | 1 935 341 | 2 042 209 |
| Income-in-kind[h] | 19 263 | 17 438 | 17 668 |
| Realized gross income (1 + 2) | 1 961 920 | 1 952 779 | 2 059 877 |
| Operating & dep. charges | 1 622 114 | 1 657 641 | 1 677 038 |
| Realized net income (3–4) | 339 806 | 295 138 | 382 839 |
| Value of inventory changes | 18 304 | 320 901 | |
| Total net income (5 + 6) | 358 110 | 616 039 | |

See footnote(s) at end of tables.

## TABLE 9. FARM CASH RECEIPTS, 1984 TO 1986, SASKATCHEWAN

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Wheat[1,4] | 2 425 150 | 1 701 531 | |
| Oats[1] | 9 200 | 4 811 | |
| Barley[1] | 205 693 | 202 361 | |
| Crop ins., advances deferments, & WGSA[2] | 341 413 | 716 892 | |
| Rye | | 26 248 | 12 011 |
| Flaxseed | 52 939 | 64 687 | |
| Canola/Rapeseed | 395 380 | 375 058 | |
| Soybeans | – | – | |
| Corn | – | – | |
| Sugar beets | – | – | |
| Potatoes | 5 966 | 6 465 | |
| Fruits | – | – | |
| Vegetables | – | – | |
| Tobacco | – | – | |
| Other crops[5] | 75 447 | 56 991 | |
| Total crops | 3 537 436 | 3 140 807 | 3 242 337 |
| Cattle and calves | 527 520 | 522 262 | |
| Hogs | 97 615 | 95 063 | |
| Sheep and lambs | 2 269 | 2 122 | |
| Dairy products | 75 519 | 76 021 | |
| Poultry | 31 078 | 27 256 | |
| Eggs | 18 885 | 18 385 | |
| Other livestock | 15 564 | 14 031 | |
| Total livestock | 768 450 | 755 140 | 776 010 |
| Other cash receipts[3] | 51 826 | 293 738 | –25 633 |
| Total cash receipts | 4 357 712 | 4 189 685 | 3 992 714 |

## TABLE 9A. FARM OPERATING EXPENSES AND DEPRECIATION CHARGES, 1984 TO 1986, SASKATCHEWAN

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Taxes[a] | 83 420 | 104 830 | |
| Gross farm rent | 245 588 | 245 314 | |
| Wages to farm labour | 171 033 | 171 277 | |
| Interest on indebtedness[b] | 432 124 | 399 490 | |
| Total machinery expenses[c] | 665 920 | 696 736 | |
| Fertilizer and lime | 299 510 | 333 055 | |
| Other crop expenses[d] | 256 284 | 294 906 | |
| Feed[e] | 92 320 | 92 505 | |
| Other livestock expenses[f] | 24 687 | 27 381 | |
| Repairs to buildings[g] | 34 433 | 34 330 | |
| Electricity and telephone | 60 471 | 62 890 | |
| Miscellaneous[z] | 236 713 | 253 630 | |
| Total operating expenses | 2 602 503 | 2 716 344 | 2 660 418 |
| Depreciation on buildings | 57 989 | 55 321 | 52 002 |
| Depreciation on machinery | 655 855 | 628 633 | 634 919 |
| Total operating expenses and depreciation charges | 3 316 347 | 3 400 298 | 3 347 339 |
| *Income of farm operators from farming operations* | | | |
| Cash receipts | 4 357 712 | 4 189 685 | 3 992 714 |
| Income–in–kind[h] | 40 539 | 40 768 | 40 619 |
| Realized gross income (1 + 2) | 4 398 251 | 4 230 453 | 4 033 333 |
| Operating & dep. charges | 3 316 347 | 3 400 298 | 3 347 339 |
| Realized net income (3–4) | 1 081 904 | 830 155 | 685 994 |
| Value of inventory changes | –712 315 | 161 136 | |
| Total net income (5 + 6) | 369 589 | 991 291 | |

See footnote(s) at end of tables.

## TABLE 10. FARM CASH RECEIPTS, 1984 TO 1986, ALBERTA

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Wheat[1,4] | 1 005 418 | 710 695 | |
| Oats[1] | 24 307 | 15 372 | |
| Barley[1] | 299 871 | 272 887 | |
| Crop ins., advances deferments, & WGSA[2] | 216 482 | 442 906 | |
| Rye | | 14 227 | 5 873 |
| Flaxseed | 7 134 | 7 406 | |
| Canola/Rapeseed | 388 335 | 309 240 | |
| Soybeans | – | – | |
| Corn | – | – | |
| Sugar beets | 17 820 | 2 570 | |
| Potatoes | 26 731 | 30 368 | |
| Fruits | – | – | |
| Vegetables | 20 153 | 24 900 | |
| Tobacco | – | – | |
| Other crops[5] | 59 067 | 57 978 | |
| Total crops | 2 079 545 | 1 880 195 | 1 714 065 |
| Cattle and calves | 1 162 645 | 1 185 131 | |
| Hogs | 254 732 | 245 334 | |
| Sheep and lambs | 5 149 | 6 340 | |
| Dairy products | 226 251 | 228 184 | |
| Poultry | 91 868 | 81 017 | |
| Eggs | 46 653 | 44 030 | |
| Other livestock | 28 896 | 25 218 | |
| Total livestock | 1 816 194 | 1 815 254 | 1 757 831 |
| Other cash receipts[3] | 48 888 | 123 492 | 175 423 |
| Total cash receipts | 3 944 627 | 3 818 941 | 3 647 319 |

## TABLE 10A. FARM OPERATING EXPENSES AND DEPRECIATION CHARGES, 1984 TO 1986, ALBERTA

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Taxes[a] | 48 780 | 50 731 | |
| Gross farm rent | 189 011 | 184 001 | |
| Wages to farm labour | 195 862 | 200 471 | |
| Interest on indebtedness[b] | 435 171 | 415 795 | |
| Total machinery expenses[c] | 543 156 | 566 294 | |
| Fertilizer and lime | 336 070 | 351 702 | |
| Other crop expenses[d] | 203 580 | 203 305 | |
| Feed[e] | 261 124 | 230 979 | |
| Other livestock expenses[f] | 143 679 | 89 183 | |
| Repairs to buildings[a] | 45 402 | 45 175 | |
| Electricity and telephone | 60 250 | 62 266 | |
| Miscellaneous[g] | 231 678 | 245 224 | |
| Total operating expenses | 2 693 763 | 2 645 126 | 2 535 759 |
| Depreciation on buildings | 107 363 | 102 425 | 96 280 |
| Depreciation on machinery | 553 499 | 546 923 | 552 392 |
| Total operating expenses and depreciation charges | 3 354 625 | 3 294 474 | 3 184 431 |
| *Income of farm operators from farming operations* | | | |
| Cash receipts | 3 944 627 | 3 818 941 | 3 647 319 |
| Income-in-kind[h] | 38 962 | 39 124 | 39 301 |
| Realized gross income (1 + 2) | 3 983 589 | 3 858 065 | 3 686 620 |
| Operating & dep. charges | 3 354 625 | 3 294 474 | 3 184 431 |
| Realized net income (3–4) | 628 964 | 563 591 | 502 189 |
| Value of inventory changes | -351 195 | -57 464 | |
| Total net income (5 + 6) | 277 769 | 506 127 | |

See footnote(s) at end of tables.

## TABLE 11. FARM CASH RECEIPTS, 1984 TO 1986, BRITISH COLUMBIA

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Wheat[1,4] | 19 745 | 12 521 | |
| Oats[1] | 1 839 | 1 034 | |
| Barley[1] | 8 131 | 8 486 | |
| Crop ins., advances deferments, & WGSA2 | 12 355 | 12 611 | |
| Rye | | 395 | 91 |
| Flaxseed | – | – | |
| Canola/Rapeseed | 9 577 | 15 723 | |
| Soybeans | – | – | |
| Corn | – | – | |
| Sugar beets | – | – | |
| Potatoes | 22 052 | 21 922 | |
| Fruits | 86 956 | 80 933 | |
| Vegetables | 68 984 | 75 787 | |
| Tobacco | – | – | |
| Other crops[5] | 83 295 | 88 744 | |
| Total crops | 313 389 | 317 852 | 325 336 |
| Cattle and calves | 148 280 | 137 465 | |
| Hogs | 47 307 | 45 270 | |
| Sheep and lambs | 1 812 | 1 524 | |
| Dairy products | 228 222 | 233 171 | |
| Poultry | 87 733 | 87 041 | |
| Eggs | 62 343 | 58 462 | |
| Other livestock | 22 057 | 21 044 | |
| Total livestock | 597 754 | 583 977 | 587 195 |
| Other cash receipts[3] | 50 875 | 55 189 | 62 407 |
| Total cash receipts | 962 037 | 957 018 | 974 938 |

## TABLE 11A. FARM OPERATING EXPENSES AND DEPRECIATION CHARGES, 1984 TO 1986, BRITISH COLUMBIA

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | $ 000 | |
| Taxes[a] | 14 905 | 15 352 | |
| Gross farm rent | 16 519 | 16 523 | |
| Wages to farm labour | 139 822 | 142 738 | |
| Interest on indebtedness[b] | 139 137 | 127 304 | |
| Total machinery expenses[c] | 99 676 | 100 244 | |
| Fertilizer and lime | 26 863 | 27 567 | |
| Other crop expenses[d] | 34 172 | 34 988 | |
| Feed[e] | 126 439 | 127 071 | |
| Other livestock expenses[f] | 21 867 | 23 645 | |
| Repairs to buildings[g] | 12 652 | 12 779 | |
| Electricity and telephone | 21 019 | 21 704 | |
| Miscellaneous[g] | 55 957 | 57 725 | |
| Total operating expenses | 709 028 | 707 640 | 706 702 |
| Depreciation on buildings | 35 182 | 33 565 | 31 551 |
| Depreciation on machinery | 74 399 | 75 026 | 75 776 |
| Total operating expenses and depreciation charges | 818 609 | 816 231 | 814 029 |
| *Income of farm operators from farming operations* | | | |
| Cash receipts | 962 037 | 957 018 | 974 938 |
| Income-in-kind[h] | 23 112 | 22 278 | 22 453 |
| Realized gross income (1 + 2) | 985 149 | 979 296 | 997 391 |
| Operating & dep. charges | 818 609 | 816 231 | 814 029 |
| Realized net income (3–4) | 166 540 | 163 065 | 183 362 |
| Value of inventory changes | -13 792 | -14 258 | |
| Total net income (5 + 6) | 152 748 | 148 807 | |

See footnote(s) at end of tables

## FOOTNOTES

1 Includes participation payments made by the Canadian Wheat Board directly to producers.

2 Net cash advances on farm-stored grains and deferred grain receipts plus payments under the Western Grain Stabilization Act to producers in Western Canada plus crop insurance payments.

3 Includes receipts from the sale of forest and maple products, as well as dairy supplementary payments, deficiency payments, provincial income stabilization payments, and other supplementary payments made by the federal and provincial governments.

4 Includes payments to producers by the Ontario Wheat Producers Marketing Board.

5 Includes cash receipts from floriculture and nursery, mustard, sunflower, non-grain advances, clover and grass, hay and clover, dry beans, dry peas, and miscellaneous crops.

a Owned land and buildings only.

b Interest payments on outstanding farm mortgage debts for owned land and buildings, together with interest payments on all other farm business debts.

c For the farm business.

d Pesticides, seed, irrigation, twine, wire and containers.

e Purchases through commercial channels only.

f Livestock purchases, artificial insemination charges, purebred livestock registration fees and veterinary expenses.

g Fencing, custom work, heating fuel, stabilization levies, insurance and other services not previously specified.

h Excludes imputed house rent.

# CONCURRENT SESSIONS

# LIVESTOCK AND POULTRY SESSION

## Prospective resource developments for Canada's meat industry

*L. Martin*

### INTRODUCTION

The purpose of this paper is to discuss potential resource adjustments which will need to occur in the production, processing and distribution of beef, pork and broilers in Canada. Resource adjustments depend, in turn, on structural adjustments. In order to assess these adjustments, several critical issues which effect future opportunities and constraints need to be addressed. First, it is vital to assess domestic and, for beef and pork, export demand. Second, it is necessary to assess recent trends in production levels, their causes and constraints. Third, we need to assess the competitive position of Canada's processing industry. Finally, it is necessary to broadly consider international trade policies of competing and customer nations.

Two assumptions guide my focus in these comments. First, the time frame is the next five or so years. Second, of necessity, it is assumed that the basic structure of the marketing systems for the three products will not change: beef and pork will not be supply managed and broiler will remain under supply management.

### MARKET PROSPECTS

#### Demand

Figures 1 and 2 contain per capita real expenditure on beef, pork and chicken in the U.S. since 1950. I must apologize for using U.S. data here but I have never found retail price series for beef and pork in Canada which are representative. My feeling is that demand for beef and pork in Canada has behaved at least proportionately to the U.S. The broiler series for both countries (Figures 3 and 4), are shown to contrast demand for the U.S. and Canada.

Real per capita expenditure is used instead of per capita consumption because consumption tells me nothing about demand: it only show the trend in production of a commodity. The nature of demand is not revealed until retail prices are taken into account. With them we can determine how much consumers are willing to pay for the quantities offered to them. Expenditure takes both price and quantity into account. Real, i.e. deflated, price data correct for the effect of inflation.

The figures are constructed by deflating annual average retail prices using the U.S. CPI. Real prices are then multiplied by per capita consumption to arrive at real expenditure, and real expenditure is plotted against time. The difference between real expenditure and per capita consumption as a representation of demand is illustrated by comparing the expenditure on beef to per capita consumption. Per capita consumption has been flat since 1979. Real expenditure has declined.

These data reveal much about the attitude of consumers toward the three commodities. From 1950 until the mid-1970s per capita real expenditure on beef increased steadily. Since 1979, it has declined by around 25 percent. In 1984, it was at roughly the same level as in the late 1960s.

For pork, expenditure declined until the late 1960s then grew moderately until the mid-1970s. As with beef it has declined since 1979. Unlike beef it has continued to decline to levels which set new record lows almost every year.

To my mind these data are sending a very clear message from consumers to producers and processors, "We don't want you to produce so much". There are several reasons. Many people seem to think it results, in the U.S., merely from substitution of lower priced chicken. The broiler data don't really support the argument. If they did I would expect to see a rising expenditure trend for broilers. during 1980–84, expenditure has been flat, at best.

Thus I suspect the reasons are far more fundamental and probably, long lasting. They include: an aging population; a population which is more diet conscious regarding fat, cholesterol

and fibre (and one which, in my opinion, has been misled about red meat on these issues); and substitution for meat of pastas, fresh vegetables, Mexican type foods (which are low in meat content) and stir frying (which also requires little meat). The result is a general decline in demand for meat.

It is interesting to compare the U.S. and Canadian data for broilers because the pricing structures are so different. Interestingly, the expenditure patterns are not dissimilar. Canada's higher prices are offset by lower per capita consumption.

It is clear that consumer demand for meat is declining and I see no evidence yet to hope that it is about to reverse itself. To my mind this is the single greatest factor affecting future development of the red meat sector.

## Potential export demand

There are probably very few parts of the world which can afford to pay Canadian prices for these products. This is particularly true for broilers because they can be purchased cheaper from other countries. Those areas which can afford our prices include western Europe, the U.S., Japan, a few other Pacific Rim countries and a few of the oil producing states. Most of them control imports or threaten to. Canada is effectively precluded from the European Community by a bevy of tariff and non-tariff barriers, except for very small and occasional shipments. Japan has been a relatively significant market for pork. But she has an elaborate set of trade restrictions which place an effective limit on imports. Moreover, Canada faces strong competition from Denmark, the U.S. and, more recently, Taiwan for the Japanese market. Thus, my judgment is that its potential for future growth is limited.

That leaves the U.S. As one who was involved in the countervailing duty issue this year, I am extremely skeptical about major growth in exports to the U.S. Moreover, the U.S. has a considerable stockpile of cheap feedgrains. Cheap feedgrains in the U.S. have traditionally been transformed into cheap hogs. Even without the threat of trade sanctions, the combination of the U.S. grain situation and declining domestic demand does not augur rampant growth in export demand.

While it would appear that Canada won at least a partial victory in the countervailing duty issue, the war is not over. All parties have appealed various decisions that were made in 1985 and at least one bill (Congressman Bedell of Iowa) has been introduced which if it becomes law, would make another round of International Trade Commission hearings more difficult to win. This bill would direct the ITC to consider hogs and pork to be "like products" – i.e. products which are part of a continuous line of production. Had this bill been law at the time that ITC's final decision on injury was taken last summer, there is little doubt in my mind that the vote would have been 2-1 against Canada – i.e. we would have countervailing duties on both hogs and pork. So long as the U.S. congress remains in its protectionist mood and so long as Canadian governments continue to subsidize hog production, we will face the threat of countervailing duties.

## Livestock production

There is considerable contrast in recent domestic production patterns among the three species. Broiler production (Figure 5) has trended upward over the past several years. To my knowledge there are very few constraints to at least moderate growth in the future. Most operations are at less than full capacity and could relatively easily expand output if quota allocations continue to expand.

Hog production in Canada has changed radically during the past decade, having experienced rapid growth during the late 1970s and little change during the 1980s (Figure 6). The period since the late 1970s marked major divergence from the cyclical behaviour which existed earlier. Figure 7 contains the year to year percentage change in Canada's quarterly pork supply since 1964. Notice that until the late 1970s, relatively regular production cycles were in evidence. Since then there is no discernible cyclic pattern.

In my view there are several factors which have simultaneously contributed to the change in behaviour. These include:

- the fact that Eastern Canada has become surplus in feedgrain production, making our corn prices lower during much of most years than in the U.S. corn belt. This has provided an advantage for hog production.

- supply management in poultry and dairy products which led to decisions by feed companies, particularly in Quebec, to expand feed sales by integrating into hog production.
- changes in health requirements for industrial milk to require bulk tanks in 1976, which provided a demand for the services of integrators.
- rising expectations for exports driven by Canada's entry into the Japanese market during the late 1970s
- investment in hog production facilities by producers of regulated commodities either as a means of making profit, or avoiding tax, or to speculate in hog quota.
- the plethora of government programs which have blurred market signals so that producers have not received the news that demand for their product is declining.

Unlike hog producers, beef producers have adjusted to declining demand. Figure 8 contains Canadian cattle slaughter since 1972. Slaughter has declined substantially since its peak in 1977. However since 1979 it has been relatively constant.

But this only tells part of the story: the reason that slaughter has remained constant in recent years is that we have seen a very high rate of female slaughter. The result is a rapidly shrinking cow herd. Figure 9 shows the adjustment. Unlike the U.S., Canadian cow inventories did not grow, but stayed constant during the late 1970s and early 1980s. Since then they have declined again. Since 1975, the Canadian herd has declined by 27 percent. This contrasts with a decline of 19 percent in the U.S. beef herd.

The cow herd is the factory for future production. Because it has declined so substantially, we will see much lower cow slaughter in the future, assuming that normal weather conditions materialize in the cow country of western Canada and if the market offers an incentive for herd expansion. Likewise, heifer and steer slaughter will decline because there will be fewer of them and because more heifers will go back into the breeding herd. I will not be surprised to see our cattle slaughter decline to 80 percent of 1984 levels by 1987 or 1988.

One of the things I'm supposed to comment on in this paper is technology needs. I'm not sure that new technology is particularly needed at the cattle production level. Rather we need more managers at the cow-calf level to take advantage of what is already available, a point that Charles Gracey has been making for at least a couple of years. The problems are a too low calving rate, too many calves with less than optimum growth potential and too little gain on pasture in the first year. The solutions are better selection of foundation stock, better supervision of breeding and better pasture management techniques.

The market situation in the next few years should be conducive to adjustments at this level. There will be strong demand for feeder cattle. Cow-calf managers will be able to profit from improved management practices. Even for a moderate sized herd, improvement from a 70 to an 85 percent calving rate and bringing calves off pasture in the fall at 500 lbs. or more instead of 350 lbs. will put quite a few dollars in one's pocket, when calves are priced at over $1.00/lb.

A second point about technology in the cattle business, which may not need saying, is that it has been shown that capital intensity at the feed lot level is not a paying proposition. I'm referring to such things as the expensive slatted floor barns that sprung up in Ontario during the late 1970s. Cattle feeding has been, at best, a thin margin operation and will likely remain that way. It is very difficult to see how capital intensive operations in the East can expect to compete for feeder cattle with feed lots in Alberta that have very limited capital investment per head, when feeder cattle numbers are declining at the rate they will be over the next several years.

A third implication of the declining herd for cattle producers is that producers and government need to work together to facilitate the importation of feeder cattle. Given the relatively larger liquidation of the Canadian herd compared to the U.S. there is every likelihood that Canada will move to a net import basis during the next half decade. There are three points in the marketing chain at which trade can occur: feeder cattle; slaughter cattle or finished beef. As will be pointed out below, the U.S. processing industry has some advantages over Canada's that will: a) make it difficult to import slaughter cattle; and b) provide the U.S. with an advantage in exporting beef.

On the assumption that it is to Canada's advantage to obtain as much value added as possible, it therefore stands to reason that it is to our advantage to try to import feeders. There is a large pool of them in the Southeastern states which are much closer to Eastern Canada than

that region's traditional source in western Canada. Similarly, there is a large pool of feeders in the upper midwest that could help supply western Canadian feedlots. Moreover, differences in the grading systems for finished cattle in the two countries often result in discounts in the U.S. for the kind of feeders that we pay premiums for in Canada.

The constraint to imports of feeders is Canada's health requirements. While some steps have been made in recent years to reduce the constraint, it is important now to streamline the procedures so that imports can come in easily when the market will want them in 1987 or 1988.

## The processing sector

The processing sectors for all three species have some characteristics in common, and each has some that are unique. A major disadvantage that all three have is diseconomies of size. Our largest plants in Canada have weekly single shift capacity which is smaller than the daily capacity of some plants in the U.S. As a result, no matter how efficient a Canadian plant is laid out and no matter how productive are its workers, there are simply some jobs in Canada which can't be as productive as they would be if the production line wy of some plants in the U.S. As a result, no matter how efficient a Canadian plant is laid out and no matter how productive are its workers, there are simply some jobs in Canada which can't be as productive as they would be if the production line was larger or speeded up.

A second disadvantage is that our labour costs are higher. Since many U.S. labour contracts were renegotiated in 1982/83, the average wage rate in the U.S. is around U.S. $7.50/hr, while in Canada it is close to Cdn. $12.00/hr. What is equally important is that Canadian fringe benefits are much higher than the U.S., thus making net labour costs higher. This, combined with lower labour productivity because of smaller plants means that unit manufacturing costs in Canada exceed those in the U.S. by a substantial margin.

These factors are quite important for the future of our processing industry, especially for beef and pork because our packers must compete with U.S. packers both for their inputs (cattle and hogs) and on the product market either domestically or for exports.

On the positive side, our processors have made great strides in efficiency over the past several years. Most of our plants now are single species, single story operations which have invested heavily in the skills of industrial engineers, have developed considerable technology themselves or purchased it from foreign and domestic suppliers of machinery and equipment. Automation and mechanical deboning are the order of the day for many plants. There is tremendous competitive pressure on plant managers everywhere to continuously improve efficiency, and they are responding.

I turn now to processors for individual species. In the broiler area, processors indicate to me that an added cost disadvantage they face relative to other countries is that their collection and assembly costs are higher because of our relatively small producing operations and their relatively wide geographical dispersion. When you have to go further and make more stops to assemble enough products for slaughter, it costs more. On the other hand, there appears to be more than adequate capacity to slaughter and process the number of chickens which will be produced in the foreseeable future. Moreover, processors have done a remarkable job of new product development in the past several years.

For pork, the processing sector has some things going for it. Our smaller and leaner hogs give it an advantage in bidding for Canadian hogs that partially offsets the disadvantages of plant size mentioned above Moreover, the approximately 75 percent of the hog which is now further processed is done by a set of companies which have developed a full line of excellent products. As a result, some inroads have been made into the U.S. and a few other foreign markets for these high value added products, and I expect to see more in the future.

There is often some question about capacity for the pork sector given the growth that has taken place in production. At present, there appears to be adequate capacity. In Ontario, for example, where weekly hog runs reach as many as 100 000 hd, there is capacity to slaughter up to 95 000 head with a six day kill and more than sufficient capacity in Quebec to take the rest. My sources in Ontario indicate that 95 000 head could be slaughtered with a five day kill after relatively minor investment in cooler facilities. During the past eighteen months, Ontario's slaughter has rarely reached 95 000 head because of low cut out margins created by competition for hogs by U.S. packers and poor product movement domestically, especially of loins when Canada's

exports to Japan declined. Moreover, there is extreme reluctance to invest further in coolers, or anything else which would increase capacity because of uncertainty about the underlying market situation, domestic government policy, countervail, and the continuing pressure for supply management. This is a reluctance which I can understand and with which I concur.

In the beef sector, the single most significant development over the past decade is the movement toward boxed beef. It has been estimated that up to 60% of our beef now moves in boxes. Most of the beef distributed by the major chains is distributed in boxed form. The prospects for continued penetration of boxed product is probably limited because the part of the market which purchases most of the carcasses is smaller chains and butcher shops. Many of these smaller outlets do not perceive that boxed product offers them major advantages in labour savings and may offer disadvantages in their merchandising activities.

Boxing is an innovation which brings substantial economic advantages to the industry. Two major advantages are improved labour productivity and transportation costs, factors which are needed to bring beef prices to a better level relative to other foods. A third advantage is that processors can respond better to market demands by having the flexibility to break carcasses centrally and allocate the components among various markets.

Boxing has, unfortunately, been a decidedly mixed blessing to the processing sector. Two major problems have arisen. First, the industry has probably gone too far in demanding an extremely wide array of product specifications. This gives the processor problems in production scheduling and therefore, keeps labour productivity well below levels that could be achieved if only a few standard specifications were produced. In turn, this has two negative effects. First, the additional manufacturing costs partially offset the benefits in transportation and distribution costs. Second, when combined with higher labour costs and smaller plant sizes, it places the domestic industry at a considerable cost disadvantage relative to its U.S. competitors.

The second major problem is that the processing sector has excess boxing capacity even at today's slaughter levels. This problem is scheduled to become worse over the next few years as the effect of herd liquidation becomes apparent. Excess capacity has effectively squeezed margins for boxing operations as everyone scrambles to keep lines operating at capacity.

The slaughter segment of the industry has fewer problems of excess capacity because of rationalization that has already occurred. However, the problem will become more acute in the future.

## Convergence – Implications for resource development and structural change

To summarize the foregoing, the major points are that over the next few years:

- domestic demand for broilers will likely increase slightly.
- domestic demand for beef and pork will continue to decline.
- there is little scope for growth in export demand for broilers, because of Canada's pricing structure.
- there is limited scope for growth in export demand for pork because: a) Canada is effectively shut out of most markets with the ability to pay for our product; and b) we face both the possibility to trade sanctions in the U.S. and the real possibility of increased competition from U.S. product. There may be limited potential for growth in exports of branded, further processed product.
- Even if there was potential growth in export demand for beef, there is little possibility Canada would likely be able to tap it because of the precipitous decline that has occurred in our cow herd.
- Broiler production has grown steadily. Pork production increased substantially during the late 1970s and has not declined in response to decreasing demand in the 1980s. Beef production has declined and will continue to do so.
- Our processing industries have made rapid strides in technological development, efficiency and product development. However, they continue to suffer a competitive disadvantage relative to the U.S. because of the latter's economies of size, lower wage rates and fringes and, in the case of the beef segment, excess capacity and a plethora of product specifications in boxing operations.

The scenario I've painted has several implications.

- Broiler chickens will continue to take market share from beef but will face increasing price competition from pork and slightly more resources will be devoted to broiler production. This is due to the relative supply situation for the two red meats. Beef supplies must decline, but pork supplies will likely continue to be pressured upward by low feedgrain prices.
- There will be a continuing decline in the number of beef feedlots. This is the inevitable result of the prospect of declining feeder cattle supplies and increased competition from cow–calf operations for heifers to be held back for breeding. The two factors which may mitigate this pressure are a rapid increase in productivity by cow–calf operations and better access to U.S. feeder cattle.
- There will be little change in resources devoted to the broiler or hog processing sectors. There is currently ample processing capacity or it can be expanded with modest investment.
- There will be further rationalization of the beef processing sector. As cattle slaughter declines in response to declining demand and the reality of both the efficiency of the U.S. sector and Canada's excess capacity are felt, additional plants will close, especially in boxing, thereby reducing resources devoted to it.
- The pork producing sector may have set itself up for an unprecedented financial disaster in the next several years.The combination of factors alluded to here – i.e. continued high production levels in Canada, declining demand for pork, increasing protectionism by the U.S. Congress and low feedgrain prices put the pork industry in an extremely precarious position. The only two possible saving graces are a sudden major and, in my opinion, unlikely, increase in demand or a sudden increase in feedgrain prices.

  Canadian governments have poured millions of dollars into the hog industry during the past decade, despite declining demand. We will face, in my opinion, several unhappy choices in the future: a) allow further economic suffering by hog producers by reducing subsidies and forcing the industry to reduce the amount of resources in production; b) continue to subsidize the industry, thereby increasing public investment and inviting retaliation by the U.S.; and c) negotiate a free trade agreement with the U.S. and reduce the subsidies.

- Underlying all of what I've said is that there are certainly sufficient resources available in Canada to produce the quantity of livestock products demanded by consumers.

  Less than five years ago there was considerable hysteria, especially among CBC reporters, that there would be too little food in the world and that we should all be vegetarians and stop using grain inefficiently by feeding it to animals. The hole in that argument, which is at least as large as a horizontal freight train, was apparent to some of us even then. Since then we have many more vegetarians, many people who have reduced their consumption of meat, we've seen several chronic grain importing regions of the world turn into exporters, and we have disastrous commodity markets. Given appropriate market incentives, farmers nearly everywhere will substantially increase grain production. Therefore, there is now, has always been and will likely always be sufficient resources for both cereal and animal production.

FIGURE 1
A: PER CAPITA CONSUMPTION, BEEF, U.S., 1950–1984
B: PER CAPITA REAL EXPENDITURE, BEEF, U.S., 1950–1984

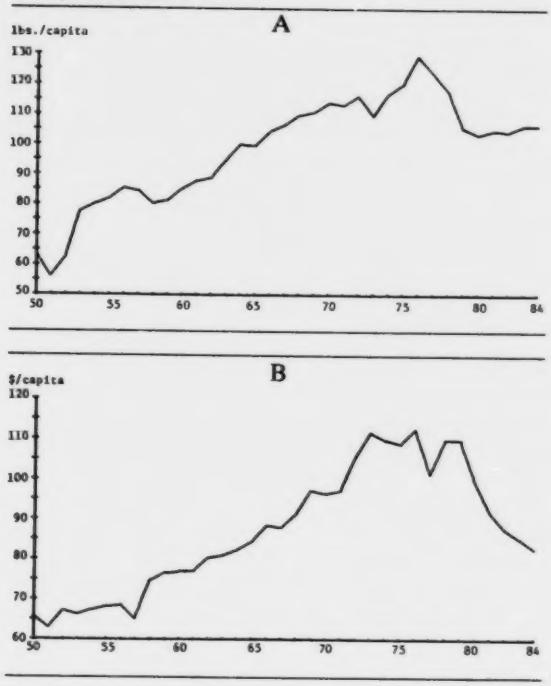



FIGURE 2: REAL PER CAPITA EXPENDITURE ON PORK, U.S.

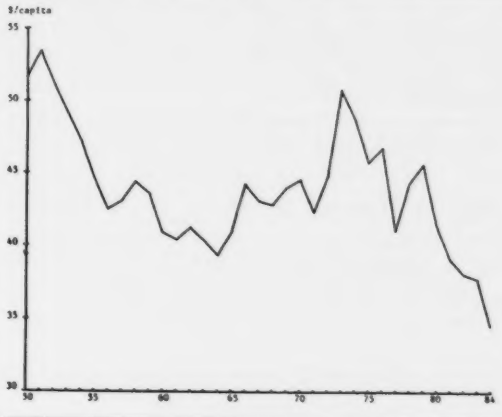



FIGURE 3. REAL PER CAPITA EXPENDITURE ON BROILERS, U.S.

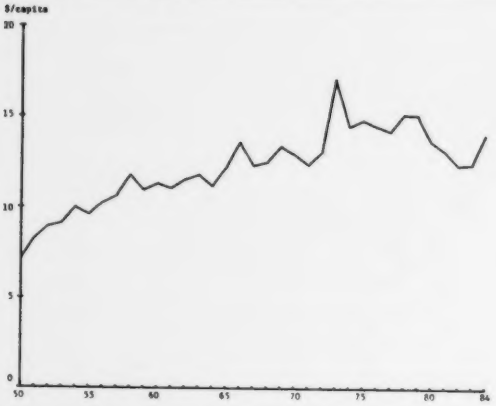



FIGURE 4: REAL PER CAPITA EXPENDITURE ON BROILERS, CANADA

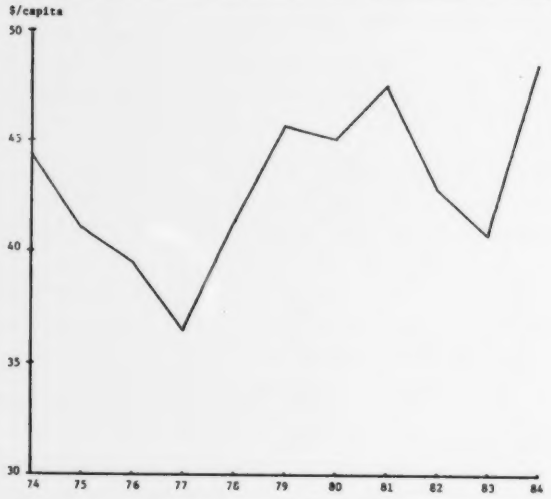


FIGURE 5: BROILER PRODUCTION, CANADA '000 TONNES, 1967–84

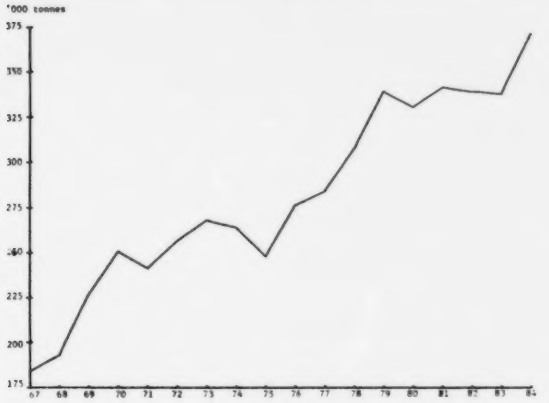



FIGURE 6: HOG PRODUCTION, CANADA

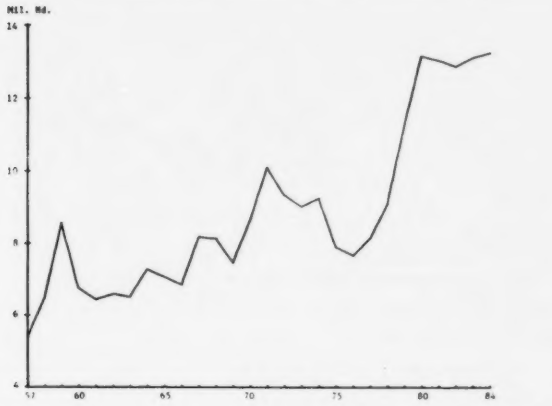



FIGURE 7: YEAR-TO-YEAR % CHANGE IN QUARTERLY HOG PRODUCTION, CANADA

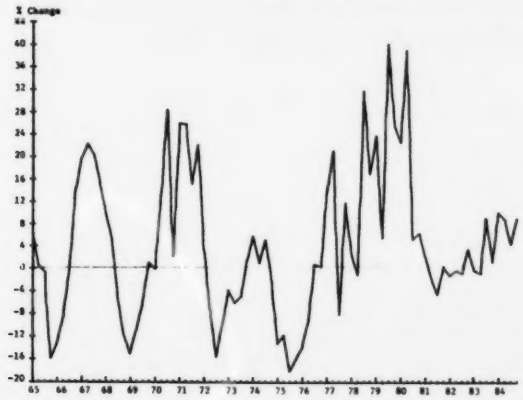



FIGURE 8: CATTLE SLAUGHTER, CANADA MILLION HEAD, 1970–84

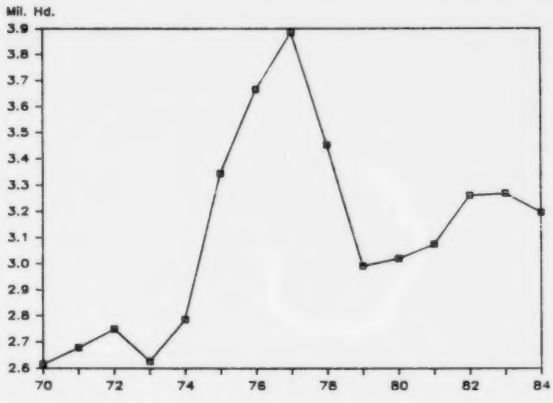
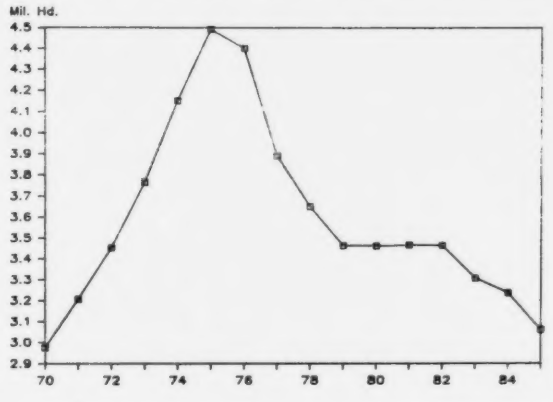



FIGURE 9: COW INVENTORIES, CANADA MILLION HEAD, 1970–84



# Comments on "Prospective resource developments for Canada's meat industry – beef"

*C. Mills*

## INTRODUCTION

I am in general agreement with the Outlook paper prepared by Allan Boswell looking at next year's cattle markets and with Dr. Martin's paper which takes a longer look at factors that will influence the supply and demand environment facing our industry and their impact on the shape of the industry over the next few years.

The Canadian Beef Industry is apparently at the bottom of the current beef cow cycle. This latest cycle has not followed the normal ten year pattern that characterised the industry since early in the century. Many arguments will probably rage as to why numbers did not recover in the early 80's as would have been expected. Poor returns from cattle, high interest rates, the cash needs of grain farmers and other reasons have been proposed. In my view the basic reason goes back to the decline in real demand for beef revealed in Dr. Martin's graphs. Not only did we produce beef through the late 70's at rates well above the kind apparent demand that we had through the early 70's but as we moved into the 80's there was a real decline in that demand and that necessitated a renewed prolonged period of herd reduction.

A number of questions have to be answered in trying to determine the direction of the Canadian beef industry over the next decade. First, has the deline in real demand for beef bottomed out? Second, how specific will beef demand be relative to the demand for other meat and protein products? And third, how competitive will the beef industry be in tomorrow's protein market?

I am going to try and address these and other questions and in the process hopefully draw a picture of the type of beef industry that I see developing in Canada over the next ten years.

## Some thoughts on demand

In looking at the material prepared by Dr. Martin, I tend to draw the conclusion that while demand for beef and pork and beef has declined and that for chicken held steady or increased, the real message is that consumers have become much more flexible in terms of the way in which they fill their protein needs. For beef that would appear to mean that if we wish to retain some share of the protein market, we must be competitive with other sources in terms of value, convenience, meeting changing life–style needs etc. While it seems that beef has lagged in adapting to new merchandising opportunities and in adapting to changing lifestyles, there seems no technical reason why we cannot compete in those fields.

And I have much less concern than most about the ability of the beef cattle industry to compete in value terms over the next decade. We still have considerable technology left to exploit. More importantly, beef production will continue to be as much a feature of available cheap feed supplies as of our ability to compete with other protein sources.

## The beef cow in Canadian Agriculture

It has to be recognized that the potential beef production in the Canadian industry is a direct reflection of the size and productivity of our beef cow and to a lesser extent our Dairy cow numbers.

In looking at the numbers of beef cows and their productivity over the next decade, a key element is an understanding of the role that the beef cow plays in the farm economy.

The value of a beef cow derives almost entirely from its ability to convert low value, low priced feed into high value protein. The numbers in our basic cow herd are a reflection of the quantity of such feed that is available in the farm economy.In Canada's case this feed supply comes from a number of sources – grazing areas that are too dry, too wet, too cold, too rough or too remote for other kinds of farming; areas within our arable farming zones that similarly are unavailable for cultivation; crop bye–products and downgraded arable crops; and lastly from the feed produced as a result of crop rotational systems adopted for reasons other than producing feed.

In considering the outlook for Canada's beef cattle industry, a basic element is the amount of

land and feed that is going to be available for raising cows and backgrounding feeder cattle and I would like to take a look at those supplies over the next few years.

## Feed supplies for the Canadian beef cow herd

In looking at the likely feed base for the Canadian beef cow herd, the following elements are important:

RANGE AREAS Cow numbers on the western ranges have been reduced sharply over the last two years – almost entirely as a result of drought. It is generally felt that our range areas in western Canada had become overstocked over the last 15 years and that some reduction was necessary. However I suggest that with more normal rainfalls, some restocking will occur over 1986 and 1987.

DEVELOPING AREAS There have been periodic attempts over the last several years to increase cattle production from the marginal areas across Canada. I do not look to see any significant increase in production from these areas in the next ten years.

ARABLE AND MIXED FARMING AREAS Cow/calf operations in the mixed farming areas account for 70% of the beef cow herd in Canada and it is in this area that the bulk of the reduction in cow numbers has occurred in the last 15 years. It is interesting to speculate as to why this happened. In my view there are several elements – the perceived poor returns from beef cattle, improved and more stable returns from other enterprises – especially grain and oilseeds, the need for cash to reduce debt, and the desire for more free time by farmers.

Looking ahead, it is my view that a number of these factors are going to turn around. Certainly I see the relative returns from cow/calf production and cash crop production changing in favour of cows as world grain markets remain depressed and as the reduction in beef supplies – and especially feeder cattle numbers – shows up in higher prices for calves and yearlings.

The availability of funds for any rebuilding of cow herds could be a problem, but I suspect that if history is any guide, as cash receipts from grain and oilseeds slide and it becomes apparent that we have a shortage of beef cows, short memoried Governments are likely to step in and re-introduce some of the programs that we had in the early 70s.

If grain markets remain sluggish, I see a rebuilding of cow numbers across much of the grain and mixed farming areas of the Prairies through 1987 and 1988.

INCREASED FORAGE CROP PRODUCTION We are already seeing a growing realization across the Prairies that the cropping practices that we have followed during the exploitation period of farm development can no longer be maintained. I see increased use of crop rotational systems across western Canada, with forage crops included primarily because of their contribution to the crop economy. Obviously however, any increased feed that results from inclusion of such crops will be consumed through suitable livestock.

## The feedlot and processing sectors

The potential size of our cattle feeding and Meat Processing industries is obviously determined by the available supply of feeder cattle adjusted by any imports or exports that occur.

I have little doubt that we are going to see considerable rationalisation and relocation of our cattle feeding sector as numbers decline. However in the long term I have no doubts about the ability of our feedlots to compete, especially if changes are made in policies affecting grain prices.

However a competitive feedlot sector also depends on the presence of an accessible, competitive and efficient meat packing industry and there I have more concerns.

It is my view that despite the problems created by high labour costs and lack of economies of scale mentioned by Dr. Martin, our cattle slaughtering facilities can and will survive. I am not nearly so optimistic about the downstream processing activities – beef boxing and consumer ready beef processing facilities serving the Canadian market could well be located south of the border.

## Productivity gains and new technology

While the cow/calf sector would appear to have considerable productivity gains available to it, any prediction that we can and will increase calving rates, weaning weights etc. has to take two factors into account.

In the first place, I go back to my original contention that the competitive strength of the beef industry lies in the ability of the beef cow to convert low value feed at a low cost into high value protein. Any technology that increases our costs significantly, without addressing the basic biology of the cow (and especially its very low reproductive rate) is unlikely to help our competitive position.

Secondly, we have to recognize that the majority of beef cows are, and will remain, in small herds on farms that are not primarily beef cow operations. Such producers will be very reluctant to adopt costly or time consuming techniques even though there may be clearly demonstrated benefits on a per cow basis.

In my view most of the productivity gains in the next ten years will come in the fields of better forage production, storage and utilisation, improved herd health, and reduced death rates and improved gains in the feedlot.

## CONCLUSION

In summary I would like to suggest that the following factors will determine the shape and size of the Canadian beef cattle undustry over the next decade:

- That the demand for beef over the next decade will depend on our ability to provide a product that meets consumer needs at a price competitive with other protein sources.
- That the competitive position of the beef cattle industry depends primarily on the available supply of low priced, low quality feed for the beef cow herd and for backgrounding feeder cattle.
- That the supply of such feed will probably increase over the next few years as range areas recover from the drought, as depressed grain markets encourage more forage production and as crop rotational systems become more prevalent.
- That supplies of feeder cattle will decline through 1986 and 1987 and that this decline together with lower grain prices will increase the relative return from the cow/calf sector and added to the adequate supplies of low cost feed will fuel a rebuilding of the cow herd and will lead to steadily increasing feeder cattle supplies through the end of the decade.
- That the majority of beef cows will continue to be kept in small herds on mixed farms and this type of operation will be slow to adopt technology already available to significantly improve productivity in the cow herd.
- That the reduced supplies of feeder cattle will put considerable pressure on the feeding and Meat Processing industries in Canada and will cause rationalisation and relocation of those industries.
- That rationalisation of the cattle feeding industry will be into larger more specialised commercial lots, which are able to apply better disease control and nutrition technology and more sophisticated risk management than in small lots. The average productivity in the feeding industry will thus improve.
- That while there will be a reduction of beef slaughtering facilities in Canada, we will retain sufficient capacity to kill most of the available cattle. However, we may well see increased exports of Canadian fed cattle and carcass beef to U.S. facilities for boxing and further processing and a consequent re–import of processed product.

# Comments on "Prospective resource developments for Canada's meat industry – hogs"

*H. Malcolm*

To begin my remarks, I have few disagreements with either the shorter term outlook presented by Larry Young or the longer run views of Larry Martin, at least from the perspective of economic trends related to Canada's pork industry. They appear to have covered the important points and tied them in together to produce interesting and useful overviews. One possible exception is the factor of exchange rates, how they are expected to move in the foreseeable future and what corresponding impacts can be anticipated for pork prices and and trade flows.

Events of the past year, however, have made it very clear to us that the outlook for our sector is as much determined by political as economic developments. This isn't intended as a major criticism of the two papers presented to us here this morning for they have handled the economics part of the question quite well, although if they were able to accurately predict the political side of it, the consulting fees they could justify would be very significant.

Just one year ago as this conference was coming to a close, the preliminary decision of the U.S. International Trade Commission was announced that there was sufficient evidence that Canadian hog and pork exports were causing injury to the U.S. industry to justify continuing the countervailing duty investigation.

Over the next eight months the Pork and Meat Councils and both federal and provincial governments were deeply involved in gathering information for the U.S. Department of Commerce in their investigation of subsidization, preparing briefs for presentation at hearings in Washington and generally defending the Canadian industry throughout the course of the complicated and controversial action. The final results were implemented on August 15 with a duty of about $7.50 for a typical market weight hog and the lifting of a temporary duty on fresh and frozen pork that had been put into effect in April.

We would like to be able to say the issue has been settled. In fact, however, three parties, the U.S. National Pork Producers Council, the Canadian Meat Council and the CPC each have filed separate complaints of decisions taken by both the Trade Commission and the Department of Commerce. Sometime in the new year we will be submitting to the U.S. Court of International Trade our detailed arguments and a request that the Court review the record of information that the trade agencies used to arrive at their conclusions. Decisions from the U.S. Court can include affirming the ITC or Commerce decisions, overturning them, or as often happens, referring the matter back to the appropriate U.S. government body for a second look, but the final outcome of the appeals is unlikely before the end of 1986.

As if this were not enough, there are at least five bills before the U.S. Congress which call for duties, quarantines and changes in U.S. trade legislation that would make it more difficult to separate pork from live hogs in making injury determinations. This last one, already referred to in Dr. Martin's paper, is advancing down the U.S. legislative track.

In addition, a whole new countervailing duty action is never out of the question. On this last point, I would like to point out that the direct substitution of pork meat for live hogs predicted by some following the lifting of the provisional countervailing duty on Canadian fresh, chilled and frozen pork exports has not taken place, in our view. According to Agriculture Canada data, exports of Canadian live hogs have indeed declined, being up by 21 percent through 1985 until the final ITC decisions and down by almost 70 percent on a year-to-year basis since then. The year-to-year increase in pork exports to the U.S. since early August of about 16 million pounds is only about one-half of the equivalent amount of pork of the decline in live hogs exports. But more importantly, the Agriculture Canada data indicates the percentage increase from 1984 to 1985 in Canadian pork exports to the United States is essentially the same since the duty on pork was lifted (by 16 1/2% from August 4 to November 16) as it was before and during the time the countervailing tariff was in place when the year-to-year increase was 17 1/2%.

What we would classify as 200 proof political were the actions taken in May of this year by a few important midwestern States to prohibit

imports of Canadian hogs because of the availability to Canadian livestock farmers of chloramphenicol, an antibiotic officially banned for use with food-producing animals in the United States. These effective bans were implemented despite U.S. monitoring efforts having not turned up any violations of their zero residue tolerance level. We have since banned the use of chloramphenicol for food-producing animals in Canada and most state restrictions have been lifted, and we acknowledge the efforts of the Canadian Government, particularly at the Embassy in Washington in this area, but it was not before traditional patterns of hog movement from western Canada into the U.S. were badly disrupted.

Also subject to political consideration are pork products imported into Canada from the European Economic Community. Having skyrocketed to more than half a million pounds or the rough equivalent of 4,000 hogs per week, in the first quarter of 1985, the issues of subsidization and price undercutting by Danish pork in particular became sufficiently sensitive in both the United States and Canada that EEC export restitutions for unprocessed pork destined for North America were slashed from close to $0.20 per pound one year ago to about $.02 today. This lower export subsidy combined with the recent devaluation of both North American dollars relative to European currencies, and Canadian pork imports from Denmark have declined significantly. The EEC export assistance has been maintained at much higher levels, however, for pork exports to other countries, most importantly, Japan. The Canadian industry is looking more closely at the reasons for the significant decline in our share of Japanese pork imports which coincides with the substantial increase in the EEC's portion, at the same time as maintaining our attention on the domestic scene.

It may just be consistent with my nature, but I don't view the prospects for the pork industry over the next few years to be as bleak as Dr. Martin fears they easily could be in his presentation today. We will continue to devote our energies to defending our interests in the face of U.S. actions but we do not assign a very high probability to being unilaterally shut out of that market and profitability would have to improve very significantly to stop the attrition that is still taking place in the hog sector in both Canada and the United States.

We would also like to think that the declining demand referred to in Larry Martin's paper can be at least moderated due to those factors relating to dietary considerations. We agree that North Americans have not been entirely well advised on the implications of eating red meat and the pork sector is getting involved along with the beef and sheep producers and the Meat Council in efforts such as Canadian Meat Month which is aimed at identifying the positive aspects of our products to the health profession, the foodservice industry, the media and consumers in general through the retail trade.

There are signs of a more balanced approach emerging on dietary advice and some of the current dialogue does acknowledge the many and important attributes of red meat as well as the inappropriateness of making recommendations to the general population to reduce their intake of meat and other animal products.

Nevertheless, the Canadian pork industry does face some outstanding challenges in order to maintain pork production, and with reasonably profitable market returns. In addition to taking whatever steps are necessary to defend our interests in export marktheless, the Canadian pork industry does face some outstanding challenges in order to maintain pork production, and with reasonably profitable market returns. In addition to taking whatever steps are necessary to defend our interests in export markets, and to promote awareness of the good quality and nutrition of our products, the pork sector should continue to move the average hog to the leaner standards being favoured by consumers and in close cooperation with the federal government, to maintain our excellent herd health position through preventing the introduction of diseases such as pseudorabies, foot and mouth, and African Swine Fever. On the former, the introduction in 1986 of electronic equipment for grading hog carcasses combined with a new index table will permit an even sharper focus on lean meat production by the pork sector.

We must intensify both basic and applied research activities that are directed toward the more efficient production of pork of the desired quality and the establishment of a standing committee on swine research within the Canadian Pork Council is an indication of the importance producers attach to research.

And finally, we must continue to examine circumstances and trends in the industry and to explore options for addressing problems and improving the position of all participants. It is in this context that the CPC is pursuing an industry study and has had initial discussions with the federal government on the matter. In the interim, we very much appreciate the kinds of effort being made to understand the pork industry's situation and outlook, such as those of Messieurs Young and Martin.

# Comments on "Prospective resource developments for Canada's meat industry – poultry"

*R. Barrie*

Dr. Martin's paper refers only briefly to the broiler industry, and I certainly don't take issue with any of his comments here. But I do feel that the general scenario he outlines has several implications for the future of supply management programs, and for the National Farm Products Marketing Council, and I'd like to share these with you.

As Dr. Martin points out in his paper, trends indicate that consumer demand for meat is declining. While the picture for broilers, and the poultry industry as a whole, is a lot brighter in my view, other farmers are facing a possible "no growth" situation, and bleak financial prospects. The future of the hog industry as underlined by Dr. Martin, is uncertain, to say the least.

So, what are the options here? During my travels I talk with a lot of farmers, and hog farmers have been asking me recently if a national supply management agency could be the answer to their problems. Many of them are thinking that there might be security and safety under a supply management umbrella – a protective blanket if you will.

And hog farmers haven't been the only ones to look to supply management as a possibility when they felt that their livelihood was threatened. The feather industries got the ball rolling, and now, tobacco growers, potato growers, and even sheep farmers, are looking at their own difficult situation and comparing it to that of farmers in the supply managed industries.

Let's look at the facts. Supply management does offer protection. Under such a system, there is less exposure to external pressures – such as the vertical integration that has taken place in the hog industry. And there is border protection.

I want to refer here to an observation by Dr. Martin, that Canadian broilers can no longer compete on export markets due to price. Now this is often a common argument used by some opponents of supply management, but I want to point out that Canada isn't the only country protecting its domestic industries. Other countries may use other techniques – tariff and non–tariff barriers, a variety of other trade restrictions, subsidies – the countervailing duty issue with the U.S. on hogs spring immediately to mind, of course – but they all amount to the same thing.

In Canada some form of protection is very necessary for the poultry industry, in particular, because without it, with our climate and the fairly high capital cost nature of the commodities themselves, they just wouldn't survive. But survive they have, and the poultry sector is probably the healthiest financially in agriculture.

Now, I don't want you to think that I have come here today to sell a national marketing agency to the hog farmers! I haven't. In fact, what I want to do is wave a red flag, to underline the realities, because the difficulties that are likely to be encountered along the way in trying to set up any new agency today are considerable.

The Farm Products Marketing Agencies Act might allow national agencies to be established, but the Number One qualifier for any successful attempt to set up an agency is provincial agreement and support. Not just from the farmers of the commodity but, more importantly, from the provincial governments. National agencies just won't get underway without provincial co–operation, and getting that federal–provincial agreement thrashed out can be a long uphill battle.

The council has had a lot of experience with this! For example – even in the mid to late 70s, it took two years to come to a federal–provincial agreement on the chicken agency. A few years later, provinces just couldn't come to a final agreement at all on a proposed potato agency for eastern Canada, even after almost two years around the table and about eight drafts of a marketing plan. For the past 18 months, we have been struggling to set up a national agency for broiler hatching eggs, and even now have only three provinces signed up.

It is an extremely frustrating exercise for everybody, not least for the farmers concerned.

But provincial support is essential. Not only to allow an agency's operations to run smoothly, but also to allow border controls to be negotiated. I'm

told that the general rule of thumb is for at least 90 percent of production to be regulated in order to qualify as a "national supply management program" under GATT.

So, the reality is that it is unlikely that the Federal Government would look seriously at any request for a new national agency, or even to amend the Act to add a named commodity, without widespread provincial support.

Having waved my red flag, just a few final comments on the existing agencies – specifically on how they are adapting to the fundamental changes going on in the poultry industry, namely, new product development: the successful development and marketing of new products by processors and further processors have created an expanding market for chicken; the egg processing sector has also boomed in the past two years, and the same could be just starting for turkey.

At the Council, we want to do everything we can to help the agencies respond to changing demands, which have, and are, creating a considerable upheaval in the agencies' operations. But progress is being made.

For the *chicken* agency, the main challenge has been to ensure that there will be enough local domestic product available for further processing needs. Taking these into account has been one of the problems the agency has run into when allocating global quota, and which has given rise to annual appeals, particularly from Ontario. This year, all provinces have accepted the level of quota they have been allocated – and the 1986 quota regulations are already approved, although two provinces wish to be heard in the New Year on the methodology used.

Changes to the annual production penalty system are also needed to make sure that when quota is allocated to a province for a given period, that quota is actually produced. Uncertainties caused by supply shortages, resulting in producer premiums and supplementary imports, or unexpected surpluses and low prices, are just not acceptable in an expanding controlled industry.

The *turkey* agency has recently revised its 1986 preliminary quota to add a further two million pounds for increased tom turkey production. This is to make sure that further processors have all the supplies they need next year. This agency is currently looking at various ways to adapt its marketing program to meet the changing needs of the market place – such as more further processing, or a switch from frozen to fresh product. The Council is giving the agency its full support in this development process.

For the *egg* agency, the current boom in egg processing is not causing headaches in the supply of product, but rather in the pricing of eggs to processors. Under the present system (in place since the mid 70s), surplus table eggs are sold to processors for domestic use at a reduced price, the difference being made up by a consumer levy added to the COP formula price for table eggs. The system worked well until the past couple of years when table egg consumption started to decline and the egg processing industry expanded. The subsidy required from table egg consumers has now become too great a burden and so, at the urging of the Council, the egg agency is trying to devise a new system for pricing eggs to processors that will be fair to all parties.

Having said that, let me add that I will be pleased to answer any questions during the panel session.

# An economic evaluation of cereal crop rotations in the Prairie provinces

*R. Schoney*

## INTRODUCTION

As much as possible, dryland farming on the prairies is based on farming practices which conserve moisture. This is not surprising as total provincial precipitation averages about 12 to 18 inches per year. Based on a 2600 d.d.1 May to September growing season, seasonal precipitation averages from 8 to 13 inches per year. Thus, a substantial amount of precipitation occurs outside of the cropping period. Dyck and Granger report that approximately 1/3 of the annual precipitation occurs as snow water. The moisture deficit in Saskatchewan is in sharp contrast to Ontario and Quebec. While most of Ontario and Quebec average about 1 inch or less of annual moisture deficit, Saskatchewan averages 4 to 12 inches of annual moisture deficit (Environment Canada).

Moisture deficits combined with a relative short growing season[2] determine cropping patterns. Probably the most unique feature of Western Prairie and Saskatchewan cropping patterns is the inclusion of summerfallow in the crop rotation. Census data in Table 1 show the varying degrees of cropping intensity in Saskatchewan by soil zone for the census years 1976 and 1981. The ratio of summerfallow to total tillable acreage (SF ratio) was 0.468, 0.438 and 0.389 for the brown, dark brown and black soil zones, respectively, in 1976.

Anderson lists the following five reasons that farmers incorporate summerfallow into their rotations (Anderson, 1981: pp. 58–61):

- moisture conservation,
- weed and pest control,
- reduction of commercial fertilizer requirements,
- profitability and
- income stability.

As in Alberta, the main reason for summerfallowing in the Saskatchewan is to store soil moisture. Summerfallowing is also practiced to allow nitrogen to accumulate from demineralization of organic matter, reducing nitrogen applications. Research indicates that a summerfallowed field has approximately twice as much available soil nitrogen as does a stubble field (University of Saskatchewan, p. 78). Summerfallowing is also practiced as a form of weed control, especially in the more humid areas of the province. Adequate mechanical control of weeds on summerfallow can require up to ten tillage operations, increasing costs and causing further deterioration in soil quality.

In contrast to the direct and immediate economic benefits of summerfallow are the adverse effects of summerfallow on soil quality through its impact on soil organic matter and salinity levels. Depleted soil organic matter levels directly affect future production through it impact on tilth, moisture holding ability and available soil nitrogen. While depleted soil organic matter levels can be restored through the incorporation of forage legumes into the rotation, this requires substantial readjustments in farming since forages require an active and viable livestock industry. Yet, livestock, particularly, dairy and beef, have not been profitable enterprises in Saskatchewan and do not promise to become profitable in the near future. While there is substantial progress being made in developing varieties of salt tolerant crops, yields are substantially less than those crops grown on non–saline soils.

## Stubble vs Fallow

While the relationship between total dry matter produced and evapo–transpiration (ET) is well established and straight forward, the relationship between grain production and ET is more complex and involves the timing, duration and the severity of stress. Nevertheless, there is a general relationship between moisture and yields for Saskatchewan farms and there also exists a relationship between spring moisture

levels and yields, Figure 1. This is the basis for farm decision making on whether or not to fallow or seed stubble. Many farmers adjust their cropping decisions from year to year as they "bet" on future weather patterns and prices according to their expectations and spring soil moistures. The latter are based on an economic threshold which is the critical moisture level for seeding/fallowing stubble. The resulting economic problem is exceedingly complex requiring simultaneous consideration of not only biological and climatic variables but also crop insurance, individual risk preferences, crop and quotas and machinery sizing and replacement patterns. To further complicate matters, it is a dynamic problem since current decisions impact on future cropping decisions through the amount of fallow and stubble crops.

Threshold values have been set by soils and plant scientists. The Saskatchewan Advisory Council recommends that crops not be seeded unless there is a minimum of 125 mm of moisture in the Brown Soils and 100 mm of moisture on the Dark Brown Soils (Dyck and Granger). However, these need to be re-examined, using economic, financial and risk variables.

Traditionally, the rotation problem has been treated as a fixed rotation. Based on fixed rotations but considering wheat quota (and, therefore, the shift to less profitable crops), adjustments to machinery size and replacement patterns, our results show that the break-even ratio between fallow and stubble yields are between 0.72 and 0.82 depending upon price, yield and machinery assumptions. Thus, when spring soil moisture can not generate yields above these ratios, fallowing becomes more profitable than stubble cropping.

## Soil moisture conservation

In essence, the problem can viewed through the simple soil moisture balance shown in Figure 2. The soil moisture balance is an accounting equation stating that soil moisture in one period is the sum of soil moisture in the previous period plus precipitation, less the sum of runoff, evaporation and transpiration (deep percolation is ignored). Spring soil moisture can be increased by not cropping for one year and thereby removing plant transpiration losses (assuming adequate weed control) and carrying surplus moisture to the following year. However, summerfallowing is not a very efficient method of conserving and storing moisture. Research has shown that most of the moisture conserved by summerfallowing occurs in the first winter when the field has crop stubble to trap snow rather than in the second winter when the field is bare (University of Saskatchewan, p. 71).

Alternatively, spring moisture can be increased by 1) increasing effective precipitation through snow entrapment techniques or 2) reducing moisture losses by reducing runoff and evaporation losses. Potential water and snow management alternatives include the following:

- Stubble strips – strips of taller stubble;
- Alternate height swathing – adjusting stubble height up and down during alternate passes;
- Tall Stubble – straight combining and leaving the stubble as tall as possible;
- Chemical fallow – leaving the stubble on fallow;
- Trash management – leaving an uniform cover of trash;
- Strip cropping – orientating fields to long, narrow strips facing north and south with alternating strips of stubble/fallow.
- Sunfallow – planting strips of sunflower, safflower and flax on summerfallow to trap snow.
- Shelter belts – planting rows of trees or perennial grasses in rows between fields.

The Innovative Acres project associated with FARMLAB suggest that the snow management practices have real possibilities. Spring moisture levels have been increased by as much as 4cm (Rennie et al, p. 123). However, yield increases have been less dramatic. Thus far, the results have been based on experimental research results. Crucial to the analysis moisture conservation technologies is the understanding of Saskatchewan and Western Prairie cost relationships.

## Costs of producing wheat in saskatchewan

High fixed costs of producing cereals are a major feature in producing grains on the Western Prairie Provinces: machine and building ownership charges, land costs and management charges account for approximately 60 to 80 percent of the total costs, possibly the highest

proportion of any Canadian farm type. Figures 3 and 4 present the costs of growing wheat of fallow (including the cost of fallowing) and wheat on stubble based on the farmers participating in the 1985 Top Management Workshops.[3] Note that all costs are based on an opportunity costs and that capital charges are based on 13.5%. A vast majority of the costs are fixed—74.8% of average total costs are fixed under a two-year rotation (Figure 3). Even if machine fixed costs are excluded from average total fixed costs, 41.4% of the costs are fixed. Using Figure 4 and the costs of growing wheat on stubble, a continuous rotation of wheat on stubble generates considerable increases in materials costs due to increased fertilizer costs. On the brown soils, a total of 25.2% of average total costs per acre are associated with variable inputs such as fertilizer, chemical and custom services.

While there is variation among farmers in input costs per acre, our data suggests that there is remarkable little variation in materials, power and repair costs among better farmers. This is illustrated by Figure 5 where the low and high cost producers are presented. High- and low-cost participant subgroups were formed based on the average total cost for the entire enterprise[4] and their mean values reported for each of the various cost components. There is remarkably little variation in direct costs per acre between the low cost and high cost subgroups. Based on 1985 results (not shown here) most of the cropping enterprises have cost subgroup means which fall $\pm$ 5% of the group mean, indicating relatively uniform direct costs for a given soil zone.

Most of the variation in average total costs comes from two sources: yields and machinery and building fixed costs. Machinery and building fixed costs are $\pm$ 30% of the group mean for Wheat on Stubble.

The distribution of costs are also important. The distribution of average total costs and yields are based on the dark brown soils because there are more participants on the dark brown soils than on the brown soils. Histograms are constructed in Figures 6 and 7 show the distribution of costs on per acre and a per bushel basis. While farm numbers are too few to be conclusive, costs on per acre basis seem to have a slightly longer tail on the left but costs on per bushel basis seem to have a slightly longer tail on the right.

The distribution of yields (Figure 8) are based on participant estimates of "expected" yields based on long run average yields and may be biased.[5] Again there is a considerable variation but a sizeable group showing between 25.1 to 27.4 bushels.

Thus, there is strong incentive to reduce average total costs per acre by reducing the proportion of fallowed acre; high proportions of summerfallow can result in high average fixed costs due to low utilization of machine, management and land resources.

## CONCLUSION

Moisture conserving technologies will continue to play a strong role in influencing crop selection, production, rotations and machine patterns. However, the analysis of any technology must take place within the context of the whole farm. This includes consideration of cropping rotation, soil moistures and farm cost structure. The current cost/price squeeze is encouraging Western Prairie grain producers to search for new ways to reduce costs and expand revenues. This means that technologies which increase spring soil moisture will enable farmers to crop a higher proportion of their land with a corresponding reduction in fallow.

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1 Degree days (d.d.) are based on a 42 degree (F) average daily temperature.

2 Most of Saskatchewan has between 80 to 100 frost–free days, with a small portion having 110 frost–free days.

3 For definitions of the various cost procedures and definitions refer to "1985 Costs of Producing Crops and Forward Planning Manual for Saskatchewan," Bulletin FLB 4, Department of Agriculture Economics, University of Saskatchewan and FARMLAB. (1985)

4 Mean production costs reported are weighted by individual acreages in order to reduce the influence of small acreages where the crops may be experimental for an individual and therefore, not be representative of commercial producers. Note that the reported yields are projected yields not actual yields because of the forward planning nature of the workshops. Also note that these divisions are based on average total costs per bushel. The individual cost components reported are for these groups – not the high or low cost groups for the individual component.

5 These yields are elicted in January, February and early March.

TABLE 1 SUMMERFALLOW ACREAGES BY SOIL–CLIMATIC ZONE, ALL CENSUS FARMS, 1976 AND 1981, SASKATCHEWAN

| Soil | 1976 | | 1981 | | % change (Acres) | % change SF Ratio |
|---|---|---|---|---|---|---|
| | Acres | SF* | Acres | SF* | | |
| | ('000) | | ('000) | | | |
| Brown | 4909.3 | 0.468 | 4 931.6 | 0 456 | +0.5 | –0.012 |
| Dark Brown | 6 257.1 | 0.438 | 6 098.7 | 0.413 | –2.5 | –0.025 |
| Black & Gray | 6 592.2 | 0.387 | 5 536.8 | 0.303 | –16.0 | –0.084 |

* SF = summerfallow.

*Source*: 1981 Census of Agriculture.

TABLE 2 ESTIMATED BREAK–EVEN STUBBLE–TO–FALLOW WHEAT YIELD RATIOS, BY ROTATION AND SOIL ZONE [1]

| Wheat Price ($/bu) | Spring Wheat | | Winter Wheat | |
|---|---|---|---|---|
| | Base Machines | Resized Machines | Base Machines | Resized Machines |
| | | (Brown Soil Zone) | | |
| 4.46 | 0.77 | 0.76 | 0.72 | 0.73 |
| 4.95 | 0.73 | 0.72 | 0.69 | 0.69 |
| 5.45 | 0.71 | 0.69 | 0.67 | 0.67 |
| | | (Dark Brown Soil Zone) | | |
| 4.38 | 0.71 | 0.74 | 0.61 | 0.65 |
| 4.87 | 0.70 | 0.69 | 0.61 | 0.63 |
| 5.36 | 0.67 | 0.67 | 0.60 | 0.60 |

[1] Based on wheat on fallow yields of 27.0 and 29.0 bushels, respectively for the brown and dark brown soils.

TABLE 3 ESTIMATED BREAK–EVEN STUBBLE–TO–FALLOW WHEAT YIELD RATIOS, BY ROTATION AND SOIL ZONE, BASE MACHINES, MACHINERY INVESTMENT PER CROP ACRE HELD CONSTANT[1]

| Wheat Price ($/bu.) | Spring Wheat | Winter Wheat |
|---|---|---|
| | (Brown Soil Zone) | |
| 4.46 | 0.82 | 0.82 |
| 4.95 | 0.81 | 0.78 |
| 5.45 | 0.78 | 0.75 |
| | (Dark Brown Soil Zone) | |
| 4.38 | 0.76 | 0.72 |
| 4.78 | 0.75 | 0.66 |
| 5.36 | 0.74 | 0.63 |

[1] Based on wheat on fallow yields of 27.0 and 29.0 bushels, respectively for the brown and dark brown soils.

**Figure 1. Yield vs Spring Moisture, Beginning Soil Moisture**

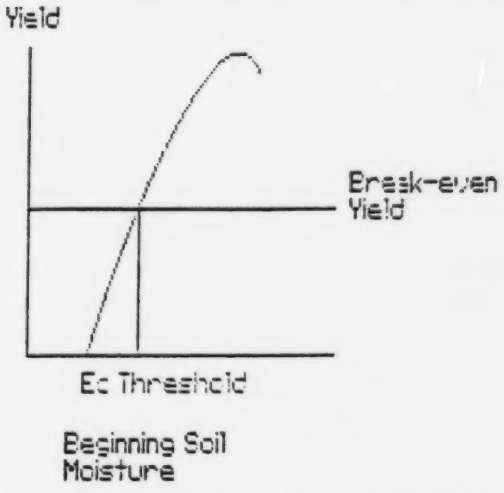



**Figure 2. Spring Moisture**

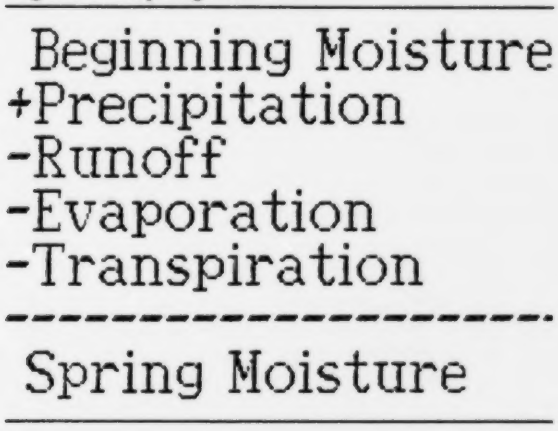



**Figure 3. Wheat on Fallow Costs, 1985–Saskatchewan Brown Soils**

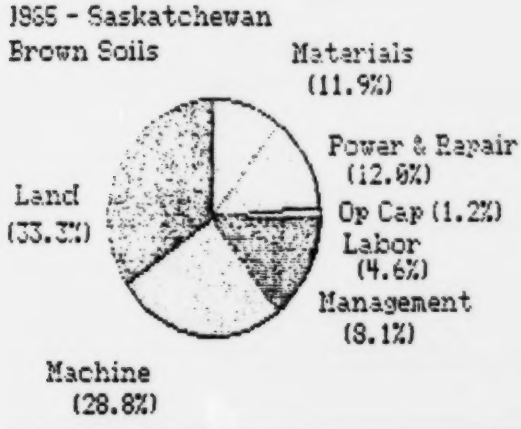



**Figure 4. Wheat on Stubble Costs, 1985–Saskatchewan Brown Soils**

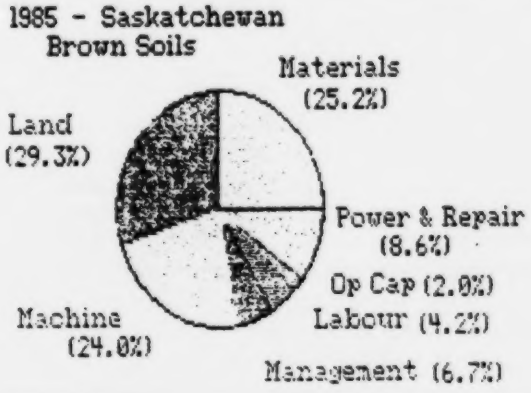



**Figure 5. High vs Low Cost Producers, Dark Brown soils, Saskatchewan–1985**

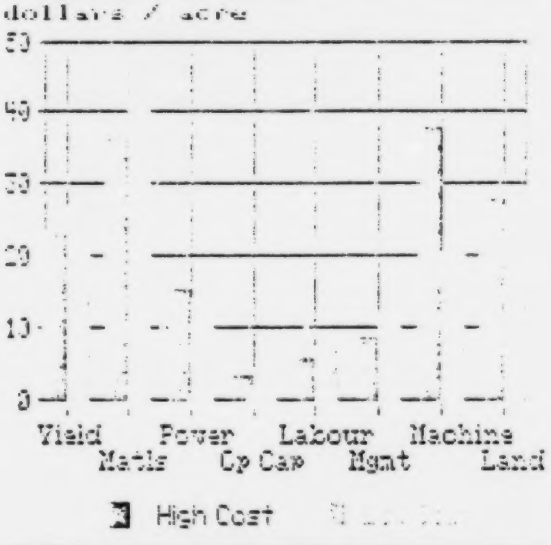


Figure 6. Cost of Growing Wheat on Stubble, Saskatchewan Dark Brown Soils–1985

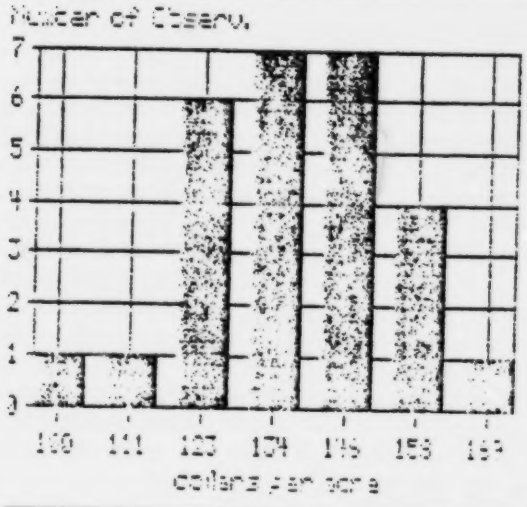



Figure 7. Cost of Growing Wheat on Stubble, Saskatchewan Dark Brown Soils–1985

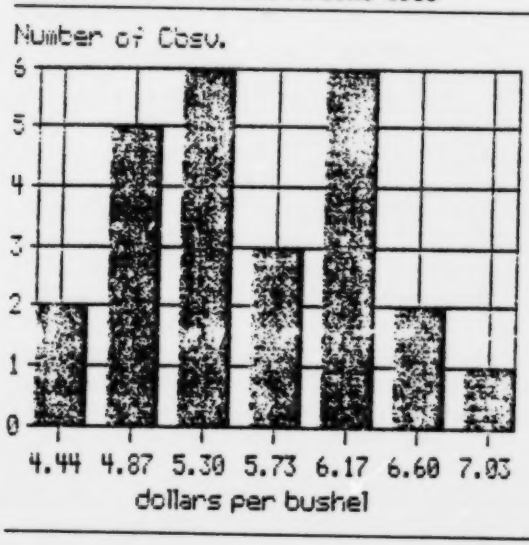



Figure 8. Yields on Wheat on Stubble, Saskatchewan Dark Brown Soils–1985

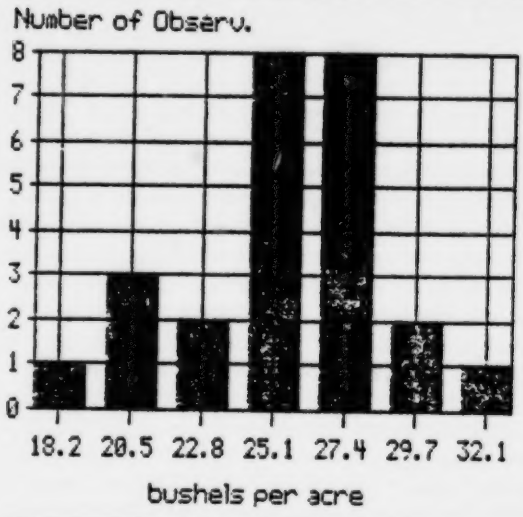
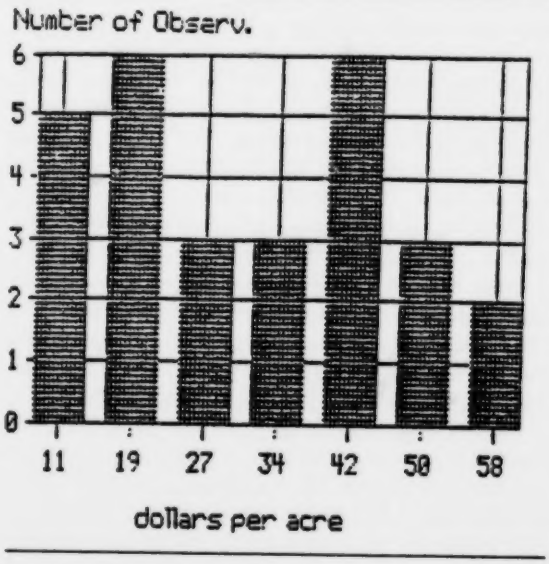



Figure 9. Fixed Costs of Machines for Wheat on Stubble, Saskatchewan Dark Brown Soils–1985



# Implications of the seasonal variability of soil erosion on crop production

*G.R. Mehuys and P.C. Kirby*

Should we be concerned with the soil erosion that is occurring or has already occurred in Eastern Canada? What are its impacts, if any, on crop production, and on grain production in particular? We begin with an overview of these questions and provide some estimates of the cost of soil erosion to Eastern Canadian agriculture. Our purpose however is not to present a detailed analysis of this topic, but merely to place soil erosion in the wider context of soil degradation. General overviews of soil degradation problems in Eastern Canada, including soil erosion, have been recently prepared for the Science Council of Canada (Mehuys 1984, Miller 1984, Monenco 1985) and brought together in a paper which was presented by M.H. Miller of the University of Guelph to a joint session of the Canadian Society of Agricultural Economics and the Canadian Society of Soil Science in June of this year (Miller 1985). Having introduced the subject, we will then review the Universal Soil Loss Equation and discuss some of its uses and misuses. One of its main limitations is that it was developed originally to predict long-term soil loss from fields under summer rainfall conditions. Thus, under our conditions, it might be valid only for approximately six months of the year. Research on winter soil erosion has shown that the inherent erodibility of a soil varies greatly with the season. We will present some of our own results on winter soil erosion in Quebec and use these data to predict how certain cropping practices might be implemented in order to limit soil loss on an annual basis to tolerable levels.

The main soil degradation problems in Eastern Canada are erosion by wind and water, compaction, loss of organic matter, and acidification. From the point of lost production, erosion is the most serious degradation problem in Ontario and Atlantic Canada and ranks second to compaction in Quebec (Table 1).

Many of the soil degradation problems faced by farmers are due to their shift from a mixed farming system, which invariably included a livestock component, to intensive cultivation practices associated with row cash-crop production (corn, soybeans, potatoes, tobacco, sugar beets), often in the absence of any livestock. One reason erosion is not as serious a problem in Quebec as in the other regions of eastern Canada is because the soils best suited to row crop production in Quebec are concentrated mainly in the flat-lying St. Lawrence-Ottawa lowlands. Erosion by water is the dominant form in all regions, although wind erosion is significant on the sandy soils of all regions and on cultivated organic soils in Ontario and Quebec.

Loss of organic matter has been identified as a relatively minor form of soil degradation (Table 1), although it must be understood that organic-matter loss induced by intensive cropping practices may well be the root cause of both erosion and compaction. The major impact of organic-matter declines in Eastern Canada is the deterioration of soil structure, which can result in increased erosion and compaction. Unfortunately, neither lower organic-matter levels nor structural breakdown are easily quantifiable. In addition, it is very difficult to relate changes in these properties to crop performance; thus to ascribe a cost to the farmer is practically impossible.

Some attempts have been made recently to estimate the cost of soil degradation on a provincial or regional basis (Table 2). These estimates are all based on limited data and should be considered as first approximations.

The costs imputed to soil erosion do not account for losses of nutrients and pesticides (except for Ontario), nor do they include the costs associated with deterioration of the surrounding environment. The latter would include more frequent cleaning of drainage ditches and deepening of water-courses, additional drinking-water filtration expenses, not to mention the reduced aesthetic quality of lakes and streams and the polluting effects on water-based ecosystems. Thus erosion would account for well over half of the total 1/4 billion dollar cost of soil degradation eastern Canada.

While these global estimates remain speculative, research results from Ontario have demonstrated that erosion does have a significant impact on yields.

Corn yields were reduced by 12 to 52% on severely eroded areas of fields, compared to non-eroded areas, depending on soil texture and soil depth at the site of investigation (Battiston and Miller 1983). Thus, loss of production may average 35% on severely eroded areas, and 10% on moderately eroded areas. Miller (1985) has estimated that the impact of erosion would translate into an overall 3 to 5% reduction in gross farm productivity in Eastern Canada. A 5% loss of production may seem insignificant, and it would be if it were applied uniformly over all farms. Unfortunately, this is not the case. Thus conservation measures must be targeted towards those soils and fields that are most susceptible to erosion and to those on which a given degree of erosion produces the greatest yield loss.

One tool that can be used to select cropping or management practices to limit erosion by water on erodible soils is the Universal Soil Loss Equation (USLE). The USLE contains five separate factors that all must be evaluated in order to calculate a predicted soil-loss value under specified weather, soil slope, cropping and management conditions.

The USLE is written as:

$$A = R.K.LS.C.P$$

where A is the average annual long-term soil loss, R is the erosivity factor and can be determined from meteorological records, K is the soil erodibility factor, LS is the slope length and gradient factor, C is the cropping factor, and P the conservation practice factor. Under specified standard conditions (i.e., a slope with a 9% gradient and 22m long, bare soil, and no conservation practice), the LS, C, and P factors are all equal to one, and the soil loss is equal to the product of the soil erodibility by the erosivity of the rainfall or runoff water.

The USLE was developed by the USDA (Wischmeier and Smith 1978) as an empirical model of erosion by water and was based on the statistical analysis of some 10 000 plot-years of data that were accumulated since the Dust Bowl from numerous locations in the United States.

Its principal strength lies in its predictive capabilities. If the erosivity (R), erodibility (K), and slope (LS) factors are known, then the equation can be used to determine the soil loss to be expected under various cropping (C) and management (P) systems. As an example, consider the cropping factor (C). On bare soil — i.e., in the absence of a crop — its value is 1.00. When a growing crop is introduced, the C value decreases, because the crop provides a shield to the impact of raindrops which tend to dislodge soil particles and begin the process of erosion. Different crops afford different protection and therefore the C factor changes with the crop (Table 3).

The concept of the cropping factor was refined with time to take into account the changing degree of protection as the crop grew from a seedling to maturity (Table 4) and the time when the soil was left bare. Thus by changing the crop itself and/or the cropping management practices, it is possible to calculate the amount of soil erosion to be expected on an annual, long-term basis and tailor the management choice to obtain a tolerable level of erosion at a specific site.

The USLE was developed to be used at the scale of an individual field or a construction site (Wischmeier 1976), but was not designed to predict erosion on a watershed basis, although it was used for this purpose in the absence of watershed models (van Vliet et al. 1976). A further limitation of the equation is that it models rainfall-induced erosion only. Its use would thus be restricted to summer conditions in eastern Canada and its predictive value would be largely lost. Changes have been introduced in the R factor to account for winter conditions, principally snowmelt runoff (McCool et al. 1981), but, even so, the amended form of the USLE ignores any possible seasonal variation in soil erodibility (K) during the year.

With this in mind, we decided to take a careful look at soil erosion by water over the entire year in order to determine the significance of winter soil erosion. For our purposes, winter was defined as the period between the onset of soil frost and the time when the soil was again tillable in the spring based on long-term soil temperature data. Intuitively, we surmized that winter erosion constituted a large portion of the total annual erosion in Southern Quebec. Observation tended to confirm this opinion. Large rills and even small gulleys can be found on almost any sloping land shortly after snowmelt, whereas their occurrence is much less frequent during the summer.

Previous research had shown that winter erosion was extremely variable depending on location. van Vliet and Wall (1981) determined that on one soil in Southern Ontario winter erosion was of only minor significance as it constituted only about 10% of the annual total

erosion at that site. At the opposite end of the country, winter erosion in the Peace River District of British Columbia was estimated at 52% of the total (van Vliet et al. 1983). Contributions of winter erosion of up to 90% have been recorded in the Western U.S.

Fallow plots were set-up at four locations on the Macdonald College property, each having a different soil, slope gradient, and slope aspect (Table 5). The soils at three sites were coarse-textured, but the soil at the HWY site was a fine-textured clay. The sites were chosen to represent a wide range of slopes, from almost flat (ARBO site) to strongly sloping (RADAR). All sites were within 1 km of each other. Water runoff and sediment concentrations were monitored for two full years at each site.

Total average annual soil losses ranged from less than 2 to over 40 t/ha at the four sites (Table 6), with the higher losses corresponding in general to the steeper slopes as might be expected. The fine-textured clay soil was an exception. The reason for this is that summer soil losses at this site were extremely small, probably due to excellent soil structure during the summer. Under winter conditions, however, soil losses were higher as the slope steepness increased. It would thus appear that well-aggregated clay soils are not very erodible when they are relatively dry, but that they become much more susceptible to erosion when water movement through the solum is restricted, either due to water-saturation or soil-frost conditions. The contribution of winter erosion to total annual erosion (Table 6) ranged from 10 to 20% on the coarse-textured soils, but reached almost 90% on the clay soil, thus demonstrating that the relative importance of winter to summer erosion is highly dependent on the soil, not just the slope gradient, even within the same general location.

Taking a closer look at our data, each event that produced erosion was analysed separately (Onstad and Foster 1975) to determine the erodibility of the soil when erosion was actually occurring. The resultant erodibilities were grouped according to soil conditions prevailing at the time each event occurred.

Groupings included frozen soil, partly frozen soil (surface at least partially thawed), completely thawed soil, and summer conditions. Soil erodibilities, i.e., the susceptibility of a soil to erode, varied markedly between the periods chosen and were one or more orders of magnitude larger when the soils were partly frozen than at any other time (Table 7). (Table 7 is incomplete because erosion events did not occur for every soil condition at each site; the ARBO site produced only three erosion events during the two winters of observation and has therefore been not included.)

Soil erodibilities are thus strongly dependent on the season, and soils, regardless of their texture, are most vulnerable to erosion by water in early spring, during or shortly after snowmelt when the subsoil is still frozen.

The soil loss results presented earlier (Table 6) were obtained from bare plots, a situation that is unrealistic for summer conditions in eastern Canada. Had a crop been grown on the plots, summer soil losses, and therefore total soil losses, would have been reduced, but the proportion of erosion occurring during winter would have been substantially greater. In fact, erosion at the HWY site (clay soil), may well occur exclusively during the winter under a conventional cropping system of fall plowing and a bare-soil condition over winter.

In view of the seasonal variability, any anti-erosion strategy should aim to reduce erosion losses during winter. Without considering drastic and expensive anti-erosion measures requiring engineering input, such as terracing, contour cropping, grassed waterways, etc. (which may be necessary when all else fails), several simple crop and soil management strategies come to mind. These include revised tillage practices, management of trash or residue from the previous crop, a return to crop rotations and use of cover crops during the winter.

A number of possibilities were tested against our seasonal erosivity and soil erodibility data using the USLE and appropriate values for the cropping factor. In each of these scenarios, slopes were corrected to a standard 9% gradient and a 22-m length, so that results for each site would be directly comparable. We chose various scenarios with corn, but also tested winter wheat.

The primary goal of any soil conservation practice is not to eliminate erosion completely, but to reduce soil losses to a tolerable level. Soil loss tolerances for Canada have not been established, but the U.S. Soil Conservation Service has established values for the United States. They vary from about 2 to 11 t/ha per year depending on soil depth and distance to bedrock (Table 8). Soil renewal is probably faster in the U.S. than in Canada because the soils

there are deeper and the climate is generally warmer. So safe limits for Canada should probably be less than those for the U.S. Reasonable soil loss tolerance limits for Canada might be 2 to 5 t/ha. year.

Soil losses were calculated for the following cropping practices:

- Fall–plowed grain corn
- Spring—plowed grain corn
- Fall–plowed silage corn
- Spring–plowed silage corn
- Winter wheat.

Obviously, any crop reduces total annual soil losses compared to bare soil (Figures 1 to 4), but the level of reduction varies with the soil. At the ARBO site, all cropping systems achieved a considerable reduction in annual soil loss, mainly because at this site erosion occurred during the summer. Of the various scenarios tested, winter wheat appears to offer the best protection, and erosion could be reduced to a tolerable level. At the DUMP site, grain corn and winter wheat would be the best choices, but here soil loss tolerance limits would still be exceeded. Thus other strategies should be contemplated, such as the use of rotations that included 1 or 2 years of a forage crop.

At the HWY and RADAR sites, spring–plowed grain corn would offer the best soil protection. Residues of the previous crop are kept on the soil surface during the winter in this case and help prevent soil loss by cushioning the impact of raindrops, slowing runoff while trapping dislodged sediments, and providing an alternative to the soil's surface for runoff. Silage corn, on the other hand, offers less protection because the whole plant is harvested and only short stubble remains on the soil surface, whether plowing is done in the fall or in the spring.

In conclusion, soil erosion is a complex phenomenon which varies according to site, soil, and season. Conservation techniques should not be recommended for general application but rather tailored to individual soils at specific sites. On some soils, continuous row cropping, such as corn, may be feasible and, with proper residue management techniques, still limit erosion by water to within acceptable limits. On others, more susceptible to erosion at critical times, more drastic measures would be required including minimum– or no–till planting, rotation of crops, or even slope gradient and length modifications as is required, for example, in the potato–growing areas of New Brunswick and P.E.I.

It is important to reiterate that these estimated soil losses were calculated for slope gradients of 9% and slope lengths of only 22 m. In this situation, one can expect much longer slopes, and in some cases steeper slopes, that would result in much greater soil loss.

The inclusion of winter wheat in our scenarios was merely for illustration purposes. Winter wheat is becoming more and more popular, but winter kill can still be a problem in some areas. As a soil conservation practice, however, winter wheat could be treated as a fall–seeded cover crop and turned under in the spring should winter kill be severe.

It should also be noted that the conservation techniques illustrated in this paper do not take into account the economics of soil erosion. These would have to be worked out, so that a least–objectionable strategy could be recommended to the farmer and remain profitable to him in the short term. This is a challenge faced jointly by agronomists, economists, and engineers who should adopt a multi–disciplinary approach to the solution of soil erosion and crop selection problems to maintain soil loss within tolerable limits.

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TABLE 1. RELATIVE IMPORTANCE OF SOIL DEGRADATION PROBLEMS IN EASTERN CANADA

| Form of degradation | Region | | |
|---|---|---|---|
| | Ontario | Quebec | Atlantic Canada |
| Erosion | 1 | 2 | 1 |
| Compaction | 2 | 1 | 3 |
| Loss of organic matter | 3 | 4 | 4 |
| Acidification | 4 | 3 | 2 |

*Source*: Miller (1985)

TABLE 2. ESTIMATES OF THE ANNUAL COST OF VARIOUS FORMS OF SOIL DEGRADATION IN EASTERN CANADA

| Form of degradation | Region | | | Total |
|---|---|---|---|---|
| | Ontario | Quebec | Atlantic Canada | |
| | million $ | | | |
| Erosion | 68 | 10 | 11 | 89 |
| Compaction | 21 | 100 | 6 | 127 |
| Acidification | 1 | 4 | 6 | 11 |
| Totals | 90 | 114 | 23 | 227 |

*Source*: Miller (1985)

TABLE 3. THE CROPPING FACTOR (C) IN THE USLE FOR A GROWING CROP

| Crop | C factor |
|---|---|
| Fallow (no crop) | 1.00 |
| Soybeans | 0.35 |
| Corn | 0.26 |
| Small grains | 0.25 |
| Forage crop | 0.02 |

*Source*: Webber (1975)

TABLE 4. THE TEMPORAL VARIATION OF THE CROPPING FACTOR (C) FOR FALL-PLOWED GRAIN CORN

| Crop | | C factor |
|---|---|---|
| F | (plowdown to seedbed preparation) | 0.49 |
| SB | (seedbed preparation to 10% canopy cover) | 0.70 |
| 1 | (10 to 50% canopy cover) | 0.57 |
| 2 | (50 to 75% canopy cover) | 0.41 |
| 3 | (75 to 90% canopy cover at harvest) | 0.24 |

*Source*: Wischmeier and Smith (1978)

TABLE 5. SELECTED SITE CHARACTERISTICS

| Site | Soil series | Texture | Slope gradient |
|---|---|---|---|
| | | | % |
| ARBO | St. Bernard | Sandy loam | 1.2 |
| DUMP | Chicot | Sandy loam | 6 5 |
| HWY | Rideau | Clay | 11.5 |
| RADAR | St. Damase | Loamy sand | 26.0 |

TABLE 6. TOTAL ANNUAL, SUMMER, AND WINTER SOIL LOSSES AT FOUR SITES IN SOUTHERN QUEBEC

| Site | Slope | Soil loss | | | Winter Contribution |
|---|---|---|---|---|---|
| | | Total | Summer | Winter | |
| | % | t/ha | | | % |
| ARBO | 1.2 | 1.6 | 1.4 | 0.17 | 11 |
| DUMP | 6.5 | 11 | 9.5 | 1.1 | 10 |
| HWY | 11.5 | 9.4 | 1.0 | 8.4 | 89 |
| RADAR | 26.0 | 47 | 38 | 8.7 | 19 |

## TABLE 7. SEASONAL ERODIBILITIES OF THREE SOILS

| Season (soil condition) | Site | | |
|---|---|---|---|
| | Dump | Hwy | Radar |
| | Mg.ha.h/ha.MJ.mm | | |
| Frozen | 0.014 | — | 0.0059 |
| Part frozen | 0.36 | 0.18 | 0.49 |
| Thawed | — | 0.034 | — |
| Summer | 0.026 | 0.002 | 0.007 |

## TABLE 8. SOIL LOSS TOLERANCE LIMITS FOR THE UNITED STATES

| Rooting depth | Renewable soil | Non-renewable soil |
|---|---|---|
| cm | t/ha.year | |
| < 25 | 2.2 | 2.2 |
| 25–51 | 4.5 | 2.2 |
| 51–102 | 6.7 | 4.5 |
| 102–152 | 9.0 | 6.7 |
| > 152 | 11.2 | 11.2 |

*Source*: Schertz (1983)

FIGURE 1. THE EFFECT OF CROPPING SYSTEM ON MEASURED AND CALCULATED SOIL LOSS

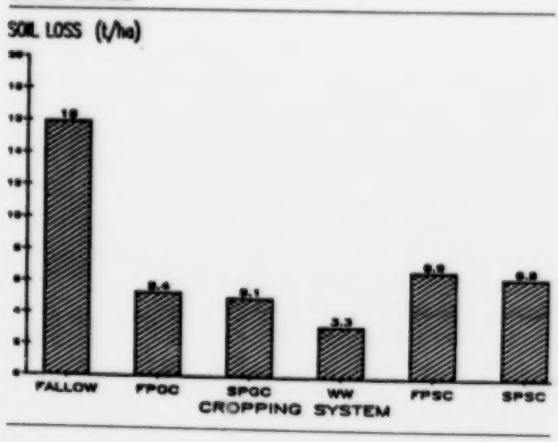



FIGURE 2. THE EFFECT OF CROPPING SYSTEM ON MEASURED AND CALCULATED SOIL LOSS

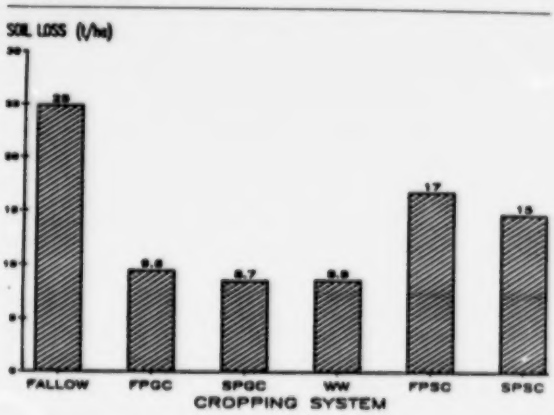



FIGURE 3. THE EFFECT OF CROPPING SYSTEM ON MEASURED AND CALCULATED SOIL LOSS

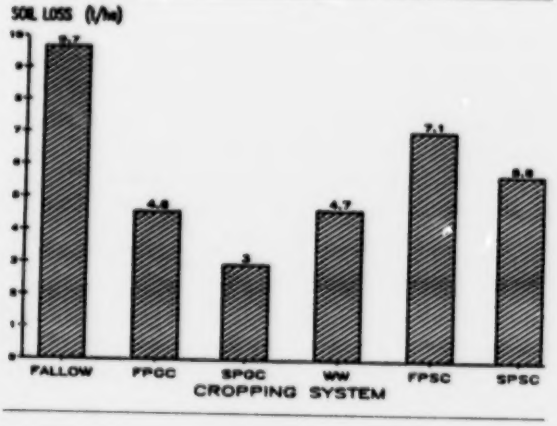
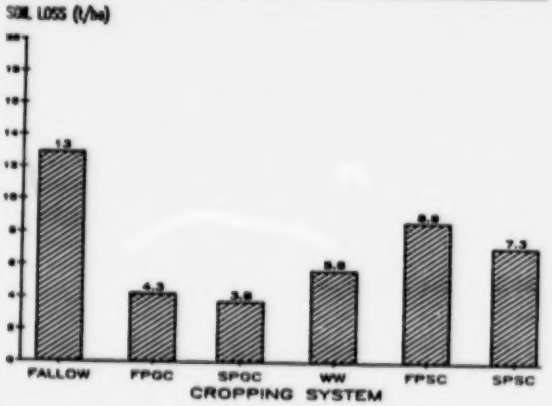



FIGURE 4. THE EFFECT OF CROPPING SYSTEM ON MEASURED AND CALCULATED SOIL LOSS



# Food aid and agricultural trade

*D. Hutton*

Agricultural Resources for the Future; Agricultural Trade; Grains and Oilseeds Outlook; This is a broad Range of subjects.

How does food aid fit into this package? In my presentation and the questions and answers session which follows, I hope to make it fit. I hope to provide you with a general appreciation of:

- The role of food aid in the development of agricultural resources;
- The business of food aid. How we determine commodities, recipient countries and other parameters of the program;
- Finally, the outlook for the food aid program and the role of grains and oilseeds in the program.

My objective is simply to present certain aspects of the food aid program to you and perhaps to clarify the approach we adopt. I have the opportunity to meet regularly with various commodity associations. On occasion, my colleagues and I get to speak to larger more diverse groups. We have found these discussions very useful. I appreciate this opportunity to speak with you today.

Food aid has played an extra–ordinary humanitarian role over the last 18 months. Famine in Africa has touched us all. In looking back at our response to this tragedy, I believe we could feel some measure of accomplishment.

Last year, the world community met for the first time – in fact exceeded – the 1974 World Agricultural Conference target of 10 million tonnes of food aid. I'm sure we will do so again in 1985. This achievement is the result of the extra efforts of a number of donors – EEC, USA and Canada being the most important. I believe we as Canadians can take some measure of pride in our response.

Already the world's largest providers of food aid on a per capita basis, Canadians fed over 2 000 000 Africans during the last 18 months through our food aid program. We were the largest donor of food aid to Ethiopia before the broader public recognition of the crisis last fall. We have been path–finders to many innovative responses to the crisis. The situation has improved dramatically in Africa. What has been accomplished is however clearly only a temporary solution. The real solution is long term food security. Food security is not and cannot be provided to Africa, or any other region at risk, through emergency food aid.

A response to an emergency situation is in a sense, an indication of failure. Increasingly food aid is recognized as an instrument for development including agricultural development rather than emergency relief. As they say in the streets, if you are not part of the solution, you are part of the problem. the long term solution is greater self reliance in Agriculture.

This involves investment – investment in human capital, land resources, infrastructure, research and technology. It also involves policy changes directed to structural adjustment. Food aid has a role to play in facilitating these critical inputs.

Notwithstanding the high priority which donors such as Canada and recipient countries are placing on investment in agriculture as the long term solution, developing countries will need enormous quantities of imported grain in coming years. There is virtually no prospect they will have the foreign exchange to import all of it on commercial terms.

A number of studies of food aid requirements in the 1990s have been done – by USA's Department of Agriculture, the Food and Agriculture Organization, the International Food Policy Research Institute. While estimates of requirements vary widely under different scenarios, it is clea. that food aid requirement in 1990 will be at least 50% higher than food aid flows in recent years. Figures of 20 millions tons have been cited.

Canada traditionally has supplied between 7–9% of total world food aid. If the above demand was met, and Canada's share retained, our program will have to grow considerably.

Let me emphasize two points. the demand for food aid is increasing even without the crisis situation recently faced in Africa. World population will grow from a level of 5 billion to 6 billion by the year 2,000. The existing number of malnourished has been put at 1 billion.

Second, the use of food aid resources simply to transfer nutrition and calories – that is to feed people – is not enough. In order to be effective,

food aid must be seen as an economic transfer – a transfer of resources for development. if not, it can even have a negative or disincentive effect. I will not get into this subject now, but would be pleased to in our Question and Answers period.

I would now like to turn briefly to the business of food aid. In a sense we are a business, albeit with a humanitarian motive. CIDA's food aid budget is over $350 Million. We purchase over 900 000 tonnes of commodities. We ship these commodities all over the world. Like any business, we take decisions on the basis of economic criteria, we allocate scarse resources and we seek to maximize our efficiency and effectiveness. We try to do better.

I have spoken about the overall demand for food aid. This demand is of course only an aggregate of individual country needs. One of the greatest improvements which has occurred as a result of the African food crisis is in the area of food needs assessments. that is the knowledge we have of the requirements for imported food, either commercially or as food aid, by developing countries. To the fullest extent possible, we try a match the agricultural products readily available in Canada with the demand in the recipient country. While the countries are chosen on the basis of their eligibility under our ODA programme and their food aid needs, commodities are chosen on the basis of their nutritional and economic value, their acceptibility to the consumer, their development impact, logistical factors, and the supply situation in Canada. Let me illustrate.

In some instances it pays to send a higher value product such as vegetable oil rather than buld cereals. If it costs $350 a tonne to ship a commodity to a land-locked African country, it makes more sense to ship a product with a value of a $1000 rather than one with $250. Otherwise, one is providing transportation not food.

In famine situations, one is trying to maximize nutritional impact. Here, fortified flour may be more effective than bulk wheat. We have developed a computer program that breaks out the unit cost of protein, calories and certain vitamins of the various commodities. This audience will be pleased to know that wheat is one of the most nutritional, cost effective transfers available to us.

Logistical factors also play a role. Some of you may know that we double bag our skim milk powder shipments with a polypropelene outer bag. These bags have a very real secondary value; $1/bag in the markets of Ethiopia. Canada means good bag in certain part of Ethiopia.

Some of you may also be aware of our efforts to improve our packaging of vegetable oil in order to enhance its secondary value.

Trade can also follow aid. A good example of this is the India Oilseeds project. Here, using Canadian Canola Oil, we were not only able to help establish a national vegetable oil capacity but also a familiarity with Canadian canola in a very large and important market. In an emergency food aid shipment to Peru last year, we were able to have the vegetable oil tariff schedule changed to allow shipments of Canadian Canola, thus potentially opening a new market. It has previously been restricted to USA soya.

Let me turn to the outlook for the food aid program and for grains and oilseeds. Historically, the Canadian Food Aid program has amounted to between 15–18% of Canada's overall programme of development assistance. As you know the government has reiterated its commitment to reach the UN target of 0.7% of GNP by 1995. The total CIDA budget for development assistance is therefore derived from a formula which is dependent on our national economic growth.

However, the proportion of the development assistance which goes to food aid is established in a negotiated rather than predetermined way. Food aid resources are in competition with all other types of development assistance, be it locomotives or technical training, for the scarce aid dollars available. I will predict that the food aid budget will increase in financial term over the next few years but I will not speculate on the percentage share of the overall ODA budget.

It is important to note that we are a cash managed not commodity managed program. Our tonnage figures are therefore derivative of commodities chosen, their price and transportation costs. From a producer's point of view this is perhaps a positive thing. We spend up to a fixed dollar amount. For recipients, at least in time of high commodity/transportation prices, it can be a bad thing.

In recognition of this fact, Canada participates in the food Aid Convention which is associated with the International Wheat Agreement. Through this vehicle we make an international commitment to ship 600 000 tonnes of cereals no matter what the price. The FAC is currently up for renewal.

Let me turn to commodity shares of the Food aid budget. Historically, cereals have comprised between 70–80% of the budget in dollar terms. We seek to have a minimum of 25% of the budget available for vegetable oil, skim milk powder, fish pulses and other non–cereals. I would see the share for non–cereals of the overall budget staying in the range of 25–30%.

What then of cereals? Particularly the split between flour and wheat. With considerable effort and a very good collaboration with Canadian National Millers' Association, we have been able to reverse the decline of flour in the program and in fact increase it from 80 000 tonnes to over 120 000 tonnes. With the loss of the Cuban market, CIDA is the only major export market for Canadian flour.

We are also working together with the association to establish new standards and extraction rates for our flour shipments for the benefit of both the producers and recipients.

I have covered a lot of ground. I stressed that food aid requirements are growing. These requirements should not be seen as a product of emergency situations only. To be successful, food aid must be a tool for development.

I spoke of the business of food aid. We can have a considerable impact on domestic and foreign markets – this can be for the good or unfortunately for the bad. I mentioned that the program will grow and that both cereals and oil seeds will grow within that budget.

I invite your questions. There is much I only touched – much more about which I said nothing. Which I'm not in a position to speculate on future policies, I'll be pleased to answer all the questions I can. If detail is required, please feel free to come up after the session.

# MILK AND DAIRY PRODUCTS SESSION

# The potential impact of bovine growth hormone on the productivity of dairy cows

*D. Petitclerc and G. Pelletier*

## INTRODUCTION

An important goal of the dairy industry is to improve the economics and productive efficiency of dairy farming. Consequently, dairy farmers must use the most advanced and efficient technology in order to secure a good income for themselves and a fair market price for their product. Productive efficiency of dairy cows can be defined as the yield of milk and milk components in ratio to the nutritional cost associated with maintenance, lactation and loss of body weight (Bauman et al., 1985b). Thus any technological advances that would increase milk yield while diluting the associated nutritional cost of production per cow would improve the productive efficiency of the dairy cow.

"Function of the mammary gland undergirds the entire dairy industry, and hormones are the primary physiological factors that stimulate mammary growth and initiate and maintain lactation" (Tucker, 1981). In dairy cattle, the major hormones related to milk production are growth hormone (GH), prolactin (Prl), insulin and thyroxine (Collier et al., 1984). Therefore, a technological advance such as manipulation of bovine growth hormone (bGH) secretion to improve milk production and feed efficiency of the dairy cow could have a tremendous impact on the dairy industry.

## GROWTH HORMONE SECRETION

The major physiological action of GH is to stimulate the synthesis of proteins and nucleic acids thereby promoting somatic growth of the organism (Kostyo and Reagan, 1976). Bovine GH is an anabolic hormone secreted by the pituitary gland, a small oval neuroendocrine gland attached by a stalk to the base of the brain (hypothalamus) and consisting of an anterior and a posterior lobe. It is a protein hormone having a primary structure compose of 191 amino acids. The control of GH secretion and the physiological actions of GH are illustrated in figure 1. Growth hormone secretion from the anterior lobe is regulated by two hypothalamic factors, somatostatin and growth hormone-releasing factor (GRF). Somatostatin, a powerful inhibitor of GH secretion, was first recognized by Krulich et al. (1968) and eventually characterized by Brazeau et al. (1973). Recently, Guillemin, Brazeau et al. (1982) isolated and sequenced three molecules with GRF activity from tumors of human pancreas: GRF (1–37)OH, GRF (1–40)OH and GRF (1–44)$NH_2$. In 1984, Guillemin et al. reported that GRF from human hypothalamic cells was identical to the GRF (1–44)$NH_2$ molecule isolated from tumors of human pancreatic cells.

In livestock, GH secretion influences growth and lactation with both direct and indirect actions on several target tissues. The direct lipolytic and diabetogenic actions of GH cause an increase in circulating levels of free fatty acid (FFA) and glucose, two essential nutrients for growth and milk production. The indirect actions of GH secretion are mediated through the secretion by the liver of growth factors under GH control. These growth factors or somatomedins will then stimulate cartilage formation, connective tissue development and protein accretion into muscle. In cattle, chronic administration of bGH will increase by 8 to 10% the live-weight gain of young dairy heifers while reducing body fat 12% (Table 1). In addition, a recent research conducted in Denmark have shown a stimulatory effect of bGH on mammary growth (38% increase).

The mechanism of bGH action on milk production is not well-understood at the moment. The proposed mechanism is a preferential partitioning (homeorhetic control) of nutrients (FFA, glucose, amino acids, etc.) toward the lactating mammary tissue to support the requirements for milk synthesis (Bauman and Currie, 1980). Indeed, bGH increases mammary blood flows as a percentage of total cardiac output

during lactation (Davis et al., 1983). However, we need to further evaluate this proposed mechanism and the role of somatomedins of mammary growth and milk production.

## MANIPULATION OF GH SECRETION

Several types of manipulation are available to increase circulating blood concentrations of GH.

First, we can inject GH directly into the animal. Because of the size (length) of the molecule, GH can only be obtained in sufficient quantities through biological synthesis (extraction from the pituitary gland, cell culture system or bacterial fermentation using recombinant DNA technology);

Second, we can stimulate the endonegous secretion of GH by injecting GRF molecules. These molecules are much shorter in length than GH and can be obtained in large quantity through solid phase chemical synthesis or biological synthesis;

Third, we can try to reduce the inhibitory action of somatostatin on GH secretion. A vaccination of the animal against its own endogenous secretion of somatostatin (autoimmunization) has been done in several species. However, this approach has not been successfull in dairy cattle thus far;

Finally, there is the possibility of combining any of these techniques particularly the second and the third methods to amplify the GH response.

## GROWTH HORMONE AND LACTATION

Over the past 50 years, numerous studies have demonstrated the galactopoietic action of bGH: that is the ability of bGH to stimulate an already established lactation. Stricker and Grueter (1929) and Azimov and Krouze (1937) were the first to stimulate milk production in rabbit and dairy cows with crude saline extract of anterior pituitary gland. Indeed, dairy cows receiving subcutaneous (sc) injection of these extracts every other day for a period of 3 weeks yield 20% more milk (Folley and Young, 1944). However, the galactopoietic action of pituitary gland extract that were initially ascribed to prolactin (Prl) was indeed due to the GH content (Azimov and Krouze, 1937 Brumby and Hancock, 1955; Cotes et al, 1949, Hutton, 1957). In 1973, Machlin clearly demonstrated that bGH preparation relatively "free of Prl and TSH contamination" would stimulate milk production 18% and feed efficiency 19% when injected every day for 10 days. Furthermore, he observed a 5 kg increase in milk yield per cow per day (35%) when injecting GH preparation every day for 8 weeks. Unfortunately, limited supply of bGH has precluded until recently the potential commercial application of bGH to improve milk production of dairy cows.

The recent discovery of recombinant DNA technology has allowed researchers to synthesize large quantity of recombinant–derived bGH (methionyl bGH). In a long term trial (84 to 272 days of lactation), Dr. Dale Bauman from Cornell University investigated the effect of pituitary–derived and recombinant–derived bGH on milk production and feed efficiency of high producing dairy cows (Bauman et al., 1985a). Methionyl bGH increased milk production from 27.9 kg/day in controls to 34.4, 38.0 and 39.4 kg/day in cows injected daily sc dose of 13.5, 27.0 and 40.5 mg/injection, respectively (Table 2). The increase in milk production ranged from 23 to 41% without any change in milk composition of dairy cows projected to yield over 9600 kg of milk at the onset of treatment. Lactational response to the injection of pituitary–derived bGH was smaller than for the recombinant–derived bGH at the same dose. "The biological basis for this difference is not obvious" (Bauman et al, 1985a) and remained unexplained for the moment. Throughout the injection period, the bGH treated cows were able to maintain their body condition and increased their feed intake in order to sustain the higher level of milk production (Table 3). Moreover, the bGH treated cows were more efficient (8 to 24%) in converting feed into milk as expressed by a higher ratio of kg FCM per Mcal NE intake (Table 3). Overall, these results are very impressive. It is apparent that while some plateau must exist in terms of milk production, the dairy cow has not yet reached this limit.

## THE GRF APPROACH

The recent discovery of GRF, a 44 amino acid peptide, provides us an alternative to stimulate bGH secretion and improve the lactational performance of dairy cattle. The amino acid sequences of human, porcine, bovine, caprine and

ovine GRF molecules are very similar (Figure 2). One of our first goals at the Lennoxville Research Station was to demonstrate that human Growth hormore–Releasing Factor (hGRF) was active in bovine and that the intrinsic biological activity of the molecule resided within the first 29 amino acids of the sequence. We then tested the ability of hGRF (1–44)$NH_2$ and (1–29)$NH_2$ fragment to release bGH in heifers (128 kg body weight) at 5 different doses (0, 0.067, 0.2, 0.6 and 1.8 nmole.kg$^{-1}$ body weight). Both molecules were equipotent in stimulating bGH release. On average, peak concentrations attained after injection were 23.6 and 25.4 ng.ml$^{-1}$ and area under the bGH curve were 1196 and 1090 ng.ml$^{-1}$.min for hGRF (1–44)$NH_2$ and (1–29)$NH_2$ fragment, respectively (Petitclerc et al, 1985b). In addition, both molecules were equipotent in stimulating milk production of dairy cows (Figure 1). Milk yield was increased 16 to 20% in late lactating cows (201 days of lactation) when injected 6 times a day (0.2 nmole.kg$^{-1}$ per injection) for 10 days (Pelletier et al, 1985; Petitclerc et al., 1985a). Thus, the (1–29)$NH_2$ fragment of the native human molecule is as effective as hGRF (1–44)$NH_2$ in stimulating bGH release and milk production of dairy cows. Most interestingly, this shorter peptide has only 1 amino acid residue different from the native bovine and caprine GRF (1–29)$NH_2$ molecule and is identical to the porcine GRF (1–29)$NH_2$.

A second objective was to prove that once a day sc injection of hGRF (1–29)$NH_2$ (10 mg per injection) could stimulate milk production of lactating cows. After 10 days of injection, we observed a 16% increase or 3.4 kg per day in milk production of dairy cows averaging 258 days into lactation and a 10% improvement in feed efficiency over control cows (Lapierre et al., unpublished). This is very comparable to the 3.9 kg/day increase obtained by Peel et al. (1983) with a higher dose (39.6 mg/day) of pituitary–derived bGH injected into dairy cows in their late stage of lactation (245 days).

## bGH VERSUS GRF

To date, there are two different technologies available to manipulate GH secretion and, therefore, improve animal performance. Both approaches use hormones that are endogenously secreted, metabolized and eliminated by the body. In short term experiment, the use of bGH or GRF yields the same results. However, more research is needed to demonstrate similar effects of GRF in long term experiment. Nevertheless, the GRF approach offers us several advantages over the bGH approach.

First, we might have a universal factor that will stimulate GH secretion in all species including man. On the other hand, the bGH approach offers the main advantage of an endogenous molecule active in cattle but not in primates, therefore precluding its uncontrolled usage in human. Second, since the GRF molecules are shorter than bGH, they can be synthesized at a lower cost through either rapid solid phase synthesis or recomb molecule active in cattle but not in primates, therefore precluding its uncontrolled usage in human. Second, since the GRF molecules are shorter than bGH, they can be synthesized at a lower cost through either rapid solid phase synthesis or recombinant DNA technology. There is also the possibility to develop super–analogues (Wehrenberg and Ling, 1983; Lance et al. 1984) and, therefore, reduce the already lesser amount of material needed per injection. However, we have to be careful and study the metabolism and the elimination by the body of these super–analogues before we use them. Finally, the higher brain negative control regulation of GH secretion through somatostatin secretion is still effective. This, to our belief, will give the animal some self–protection against over dose injection.

## IMPACT ON THE DAIRY INDUSTRY

The dairy industry is now facing a new technological revolution. Data accumulated thus far indicate that manipulations of bGH secretion can increase milk yield per cow 15 to 41%, feed efficiency 8 to 24%, growth rate of heifers 8 to 10% and mammary growth up to 38%. In a recent paper presented at a symposium of GH biotechnology, University of Illinois, 1985, Dr. L.S. Mix assumed that bGH will be approved by the Federal Drug Administration and will be in commercial use in the United States by 1988. He estimated that 80% of the U.S. dairy cows will receive the hormone by 1993 and 100% by 1998. "In a few years time, this technology should result in 25% more milk per cow per year" with consequences on milk price, dairy cow population and herd size in the U.S.

In Canada, if we use the same figure as Dr. Mix, dairy farmers will need 25% less cows to produce their milk quotas. What do we do with these extra cows? Their only avenue is probably the beef market.

The extra milk produced per cow will further dilute the fixed cost of maintenance of the dairy cow. In addition, even if the injected cows require additional feed to meet the long term demand of higher milk production, these cows are more efficient in converting feed into milk. Therefore, the overall cost associated with milk yield will also be reduced. Hence, the productive efficiency of dairy cows and the economics of dairy farming will be tremendously improved by the use of bGH technology.

Most farmers will probably be favorable to this technological revolution as long as the life performance of their cattle is not harmed. This technology will allow them to produce their milk quotas with fewer cows at a lower cost. However, the future adaptation of this technology will depend on the results of future research and the approbation by regulatory agencies, the consumer reaction and the cost–benefit ratio of the product(s).

## FUTURE RESEARCH

Research has not yet answered to all the questions.

The effect of injecting bGH or GRF to dairy cows over several lactations on milk yield and composition, reproductive performance, body condition, animal health and life expectancy needs further evaluation.

Feed intake of injected cows is increased over time. All the experiments done thus far were with animals fed total mixed rations. Can the injected cows meet the higher demand of milk production with a higher intake of forage if we limit concentrate intake?

Feed efficiency is also improved. How is it done and what are the nutrient requirements of the injected cows? What are the need during gestation and during the dry period.

Milk quality! What will be the consumer reaction? Should we worry about the excretion of these hormones in milk even though they are endogenous molecules and already present in milk?

The dairy industry evaluate dairy cow performance by comparison of animal performance with the Breed Class Average. The best sire are selected through the progeny test. Will these tests still be valid in the future if we do not standardize them in regard to GH manipulation?

Can we use GH manipulation to stimulate feed performance and mammary growth of dairy heifers with subsequent beneficial effects on milk production of the adult animal?

How will the farm revenue and the price of dairy product be affected by GH manipulation?

Finally and most importantly, can we use GH manipulation to stimulate body growth and milk production of meat producing animals in order to reduce the time needed to reach market weight?

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## TABLE 1. EFFECT OF EXOGENOUS bGH IN DAIRY HEIFERS[1]

| Reference | Live-Weight Gain | Carcass Composition | | Mammary Gland Composition |
|---|---|---|---|---|
| | | Lean Meat | Tallow | |
| | (%) | (%) | (%) | (%) |
| Brumby, 1959[2] | 10 | | | |
| Serjsen et al., 1984[3] | 8 | 2 | -12 | 38 |

1 Data are expressed as change in percentage over control.
2 N.Z.J. Agric. Research 2:683. There were 12 pairs of identical twins receiving daily S.C. injection of bGH (0.11 mg/kg bw) for 12 weeks.
3 Position paper presented at the EEC-Seminar "Improvement of biological and economical efficiency" held in Brussel, Dec. 10th 1984. There were nine pairs of identical twins receiving s.c. 20 mg of bGH per day (0.07-0.11 mg/kg BW) for 14 weeks.

## TABLE 2. LONG TERM EFFECT OF EXOGENOUS bGH[1]

| Variable | Control | Pituitary bGH (MG/day) | Methionyl bGH (MG/day) | | |
|---|---|---|---|---|---|
| | | 27 | 13.5 | 27.0 | 40.5 |
| Milk Yield (FCM kg/day)[2] | 27.9a | 32.5ab | 34 4bc | 38.0c | 39.4c |
| (%) | 100 | 116 | 123 | 136 | 141 |
| Milk Fat (%) | 3.6 | 3.3 | 3.8 | 3.6 | 3.6 |
| Milk Protein (%) | 3.4 | 3.4. | 3.4 | 3.4 | 3.4 |
| Milk Lactose (%) | 4.8 | 4.8 | 4.9 | 4.8 | 4.9 |

abc means in the same row with different superscript differ (p .05).

1 Treatment period was 188 days commencing at 84 ± 10 days postpartum. There were 6 cows per treatment. Response data (weekly means) were adjusted by covariance analysis using each individual cow's response during the excipient period.
2 FCM = 3.5% Fat-corrected Milk
Bauman et al., 1985. J. Dairy Sci. 68:6.

## TABLE 3. LONG TERM EFFECT OF EXOGENOUS bGH[1]

| Variable | Control | Pituitary bGH (MG/day) | Methionyl bGH (MG/day) | | |
|---|---|---|---|---|---|
| | | 27 | 13.5 | 27.0 | 40.5 |
| Body weight change (kg) | 22 | 21 | 20 | 21 | 17 |
| Net energy intake (MCal/day) | 34.1 | 35.1 | 36.7 | 39.2 | 37.5 |
| Feed efficiency[2] | 0.83a | 0.90ab | 0.93abc | 1.00bc | 1.03c |
| (kgFCM/MCal NE Intake) (%) | 100 | 108 | 112 | 120 | 124 |

abc means in the same row with different superscript differ (p .05).

1 Treatment period was 188 days commencing at 84 ± 10 days. There were 6 cows per treatment.
2 FCM = 3.5% Fat-Corrected Milk
NE = Net Energy
Bauman et al., 1985. J. Dairy Sci. 68:6.

**FIGURE 1. SUMMARY SCHEME OF GH ACTIONS ON GROWTH AND METABOLISM**

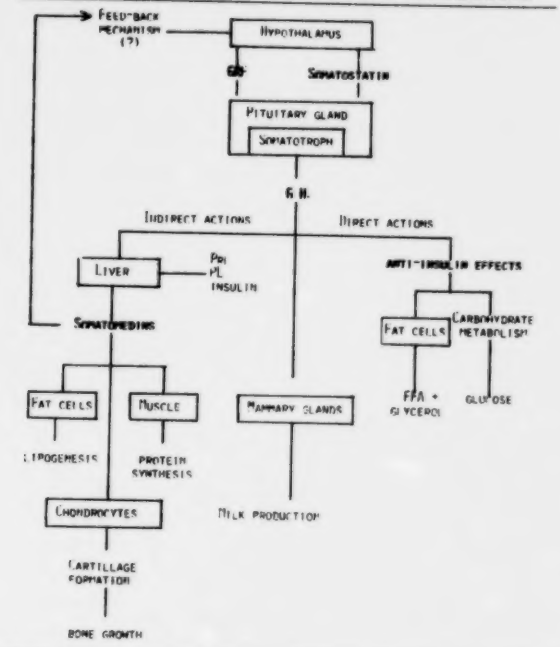
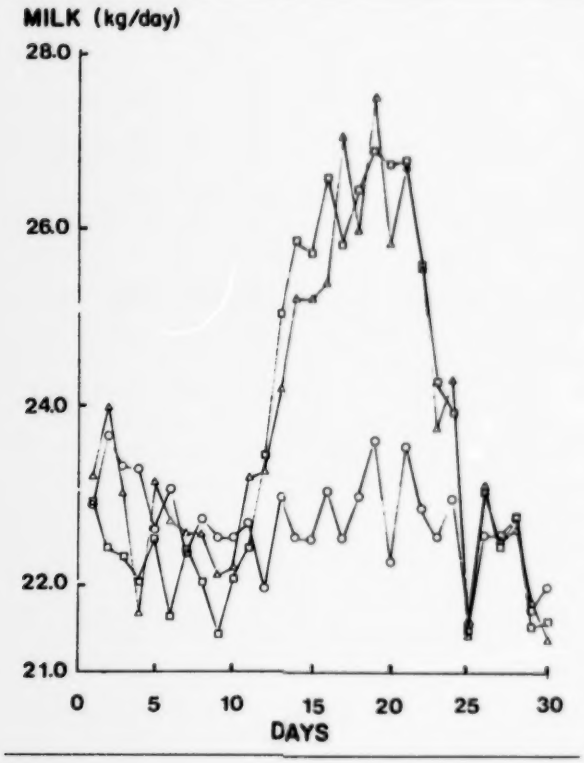



**FIGURE 2. GRF SEQUENCES**

| | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | |
|---|---|---|---|---|---|---|---|---|---|
| **HUMAN** | Y A D A I F T N S Y R K V L G Q L S A R K L L Q D I M S R Q Q G E S N Q E R G A R A R L | | | | | | | | -OH |
| **PORCINE** | Y A D A I F T N S Y R K V L G Q L S A R K L L Q D I M S R Q Q G E R N Q E Q G A R V R L | | | | | | | | -NH$_2$ |
| **BOVINE CAPRINE** | Y A D A I F T N S Y R K V L G Q L S A R K L L Q D I M N R Q Q G E R N Q E Q G A K V R L | | | | | | | | -NH$_2$ |
| **OVINE** | Y A D A I F T N S Y R K I L G Q L S A R K L L Q D I M N R Q Q G E R N Q E Q G A K V R L | | | | | | | | -NH$_2$ |
| **RAT** | H A D A I F T S S Y R R I L G Q L Y A R K L L H E I M N R Q Q G E R N Q E Q R S R F N | | | | | | | | -OH |

A-ALA G-GLY M-MET S-SER
D-ASP I-ILE N-ASN T-THR
E-GLU K-LYS Q-GLN V-VAL
F-PHE L-LEU R-ARG Y-TYR

FIGURE 3. MILK PRODUCTION OF DAIRY COWS INJECTED 6 TIMES PER DAY BETWEEN DAY 10 AND 20 WITH SALINE (OPEN CIRCLE), hGRF (1–44)–$NH_2$ (OPEN SQUARE) AND hGRF (1–29)–$NH_2$ (OPEN TRIANGLE).



# The regulations and inspection of Canadian dairy products

*P.J. Brackenridge*

First let me express my appreciation for being given the opportunity to review Agriculture Canada's policies and programs regarding the regulation and inspection of Canadian dairy products. Although not a traditional discussion topic at Agricultural Outlook conferences, it is my opinion that regulation and inspection has made, and will continue to make, a significant contribution to the growth, competitiveness and stability of Canada's dairy industry.

My intention today is to (1) situate for you the Dairy Section, Dairy, Fruit and Vegetable Division, within the Agriculture Canada organization; (2) provide you with an overview of the Dairy Products Regulations; and (3) elaborate upon the programs administered by the Dairy Section to ensure that dairy establishments and manufactured dairy products are in compliance with regulatory requirements.

## DEPARTMENTAL ORGANIZATION

The Dairy, Fruit and Vegetable Division is one of four Divisions within the Food Inspection Directorate, Food Production and Inspection Branch.

The first overhead shows in an overly simplified manner the major Branches within Agriculture Canada which report to the Deputy Minister, Mr. Connell. Within the Food Production and Inspection Branch (A.D.M., Dr. John McGowan) there are 7 Directorates (Food Inspection, Health of Animals, Agricultural Inspection, Veterinary Inspection, Plant Health & Plant Products, Pesticides, Management Services) and one Division (Race Track). I would focus your attention on the Food Inspection Directorate (D.G., Dr. Brian Morrissey) and the Agricultural Inspection Directorate, (D.G., Mr. R. Roy). Divisions within the Food Inspection Directorate, of which Dairy, Fruit and Vegetable is one of four, are charged with the responsibility of program and legislation development and monitoring of uniformity and accuracy of national program application. The Agricultural Inspection Directorate is the operational arm for our programs an is therefore responsible for program delivery.

The next overhead concentrates on my own Division, Dairy, Fruit and Vegetable which is comprised of 3 Sections – Dairy, Fresh Fruits and Vegetables and Processed Products (including processed fruits and vegetables, honey and maple products). The Dairy Section, under the leadership of Mr. John Wakelin, has three Chiefs – Mr. Jacques Lefaivre (Product Inspection and Grading), Mrs. Gail Daniels (Plant Registration and Laboratory) and Mr. Art Goll (Legislation and Labelling).

Dairy Products Regulations – After many years of development, the Dairy Products Regulations, Canada Agricultural Products Standards Act, were officially promulgated on November 15, 1979. Prior to that date the Dairy Section operated under the authority of the Canadian Dairy Products Act and Regulations. The promulgation of the new dairy regulations meant that all the major agricultural food commodities were now covered under one Act, namely the Canada Agricultural Products Standards (CAPS) Act.

At the outset I should clarify that the Dairy Products Regulations cover the international and interprovincial movement of manufactured dairy products – i.e., products which are primarily manufactured from industrial milk supplies, e.g., butter, cheese, dry milk products, evaporated milk and ice cream. Within province (intraprovincial) movement of dairy products, including fluid milk and fluid milk products, is provincial government responsibility.

There are 3 "Parts" to the Dairy Products Regulations. *Part I: Standards* – This "part" is subdivided into the following sections:

*Grades and Grade Names* – There are 3 grades of dairy products – Canada 1, Canada 2 and Canada 3 although Canada 3 (a processing grade) is only used for bulk butter and cheddar cheese.

*Terms and Conditions of Grading* – Self-explanatory e.g., product must meet composition standards, Food and Drug Regulations, specifications, etc.

*Place of Grading* – Specifies requirements. Very important due to the nature of dairy product grading.

*Regrading* – Conditions under which regrading will be performed.

*Grade Certificate* – Inspector will issue a grade certificate upon request.

*Registered Establishments* – Outlines conditions and terms for certificate of registration.

*Conditions for the Construction, Operation and Maintenance of Registered Establishments* – Self-explanatory.

*Grade Requirements for Butter and Similar Products* – Specifies grade standards for butter, dairy spread, calorie-reduced butter, whey butter, whipped butter and whipped dairy spread.

*Grade Requirements for Cheddar Cheese* – Self-explanatory

*Grade Requirements for Dry Milk Products* – Includes skim milk powder, partly skimmed milk powder, whole milk powder, buttermilk powder, whey powder, acid-type whey powder, blended skim milk and whey powder, edible acid casein.

*Packing* – Packing requirements for application of a grade name.

*Marking* – Marking requirements for application of a grade name.

*Part II: International and Interprovincial Trade* – This part is subdivided as follows:

*Export and Interprovincial Trade* – Outlines requirements (inspection, marking) for interprovincial and export trade of products specified in Part I i.e., graded products.

*Imports* – Basic requirements if intention to import product specified under Part I.

*Standards* – Outlines product standards (primarily compositional) and interprovincial and export shipping requirements for the multitude of non-graded dairy products i.e., not specified under Part I – for example, variety cheeses, cottage cheese, cream cheese, butteroil, ice cream, frozen dairy desserts, sherbet, condensed and evaporated milks.

*Packing* – Packing requirements for these products.

*Marking* – Marking requirements for these products.

*Part III: Administration* – This part is subdivided as follows.

*Inspection and Certification* – Outlines legislative mandate for activities conducted by inspection staff.

*Seizure and Detention* – Legislative mandate for seizure and detention.

There are a number of "Schedules" appended to the regulations which specify such things as container sizes, milk container specifications, official grade mark designs, etc.

I should emphasize that wherever possible e.g., product standards and labelling requirements, the appropriate sections of the Food and Drugs Regulations are quoted to ensure that the various federal inspection agencies are not contradictory.

*Programs* – There are five main program thrusts within the Dairy Section of the Dairy, Fruit and Vegetable Division, namely:

Plant Registration and Inspection;

Grading;

Product Inspection;

Laboratory;

Legislation and Labelling.

*Plant Registration and Inspection* – In the late 1960s and early 1970s a concerted effort was initiated by the Dairy Division to improve the plant inspection and registration system. Prior to that time, provincial inspections were conducted independently from federal inspections and the evaluation parameters were not uniform. There was no guarantee that a plant considered "satisfactory" in one part of the country would be considered "satisfactory" in another part of the country. It must have also been cumbersome for the industry to entertain similar inspections performed at different times by different agencies.

The results of Dairy Division's efforts, thanks to excellent provincial government and industry cooperation was the development of the Plant Registration and Inspection Program. The basic guidelines of the program are as follows:

Every registered dairy establishment is subject to one "in-depth" inspection and at least one "follow-up" inspection per year. The number of follow-ups is dependent upon the in-depth findings or observations of the Inspector during regular plant visits.

Plants are informed approximately one week prior to the "in-depth" inspection. This allows for proper scheduling and the plant can make arrangements to have qualified staff accompany the Inspectors.

Equipment "tear-downs" must be performed by plant personnel.

Should individual Inspectors have evidence that inspection notification is resulting in unrealistic evaluation, future inspections may be performed unannounced.

Discussions are held with plant management before and after the inspection. All problems noted are reviewed and agreements are made as to corrective action to be conducted. Problems and solutions are categorized as immediate, intermediate or long range.

A formal report is prepared and distributed to the plant within a few weeks of the inspection. This report provides an Item Rating Summary, and Unsatisfactory Item Report and a Plant Performance Statement.

Perhaps the single most important feature of this program however, is the Provincial-Federal cooperation which it demonstrates. Depending upon the province, inspections are conducted by provincial authorities, federal authorities or jointly. In any event, plants are evaluated on one uniform set of standards and inspections are conducted based on one set of guidelines using one type of inspection form. All plant inspection information is forwarded to Ottawa where it is compiled and tabulated by computer and returned to the field for distribution to the manufacturers. There are also a number of internal management information reports generated.

The computer has played a major role in the success of this program. The original system developed in the early 1970s was completely redeveloped approximately 5 years ago and continues to be effective in meeting today's needs.

Before leaving this program, I would just like to mention that in each Region (province) across Canada, there is a Dairy Specialist and/or Plant Registration and Inspection Specialist (Ontario and Quebec) who is responsible for ensuring regional uniformity. National accuracy and uniformity is maintained through the activities of the National Plant Registration and Inspection Specialist.

For your interest there are presently 400 registered dairy plants, plus an additional 138 plants considered "administratively" registered.

*Grading* – As touched on in my review of Part I of the "Dairy Products Regulations", grade standards exist for butter and similar products, cheddar cheese and dry milk products. Dairy inspectors presently perform grading and issue grade certificates upon request. Grade standards have traditionally provided the "quality" parameter to facilitate trade, for example, the Canadian Dairy Commission, the main purchaser of skim milk powder and butter, only buys Canada 1 quality product. For cheddar cheese, certification has been provided for sale on the open market for example, the Belleville Cheese Exchange. It is mandatory for cheddar exports.

Butter and cheddar cheese are graded based upon their organoleptic and physical properties. Dry milk products are graded based upon chemical and microbiological standards. Dairy Inspectors insist upon proper grading facilities to ensure there are no distractions (butter and cheese grading) and the environment is conducive to aseptic sampling (dry milk products). In actual fact, the sampling of dry milk products is performed by plant personnel according to specified guidelines with samples being forwarded to laboratories for testing.

Similar to the Plant Registration and Inspection Program, national accuracy and uniformity are maintained through the activities of the National and Regional Product Inspection and Grading Specialists.

For your information, the next overhead shows a summary of our 1984 grading results.

At this point, I should mention that domestic butter and cheddar cheese grading have been identified as areas where Agriculture Canada may be able to reduce its "hands-on" involvement thereby contributing to the federal government's expenditure reduction program. Based on the consistently high percentage of Canada 1 products and the demonstrated ability and willingness of the Canadian dairy industry to accept responsibility for the quality of their products, we are confident that high product standards will be maintained. It is our intention to replace our "hands-on" activities with less resource intensive monitoring programs.

*Product Inspection* – The key word within the Dairy Product Inspection Program is "F.O.I.L.", which represents the first four letters of the words Frequency of Inspection Level. The development of FOIL came as a direct offshoot of

the Dairy Division philosophy introduced in the late sixties, i.e., the Dairy industry of a responsible industry and should be given the opportunity to accept responsibility for the quality and compliance of their product. Inspection efforts should be concentrated on those plants not demonstrating acceptance of this responsibility.

F.O.I.L. is a statistically valid inspection and sampling schedule to allow for and promote flexibility of inspection activities. Based upon inspection findings related to product composition, accuracy of grading, branding and packaging, microbiological quality, and plant sanitation, products from individual manufacturers are inspected on a range of frequencies – reduced, normal, tightened, 100% and special procedures. In general terms, the more satisfactory the inspection record, the less frequent the inspection visits. Efforts are concentrated on those plants experiencing problems.

The introduction of F.O.I.L. has resulted in some manpower savings but more importantly there has been a general improvement in product quality due to direction of resources where they are most needed.

At this stage I would like to mention that in 1983 an "audit protocol" was developed through which each facility is categorized A – F (A = excellent, F = fail) based upon a combination of the plant registration rating and FOIL classification. Such a system has been introduced for all the food commodities, albeit with different parameters for each, however it provides a useful tool for management to recognize potential problems.

*Laboratory* – There are 3 basic laboratory concepts involved with Dairy programs:

*Regional Laboratories* – The Dairy Section maintains 5 regional labs across Canada. These laboratories perform routine compositional and microbiological screening tests on all products except dry milk, in support of the Product Inspection activities.

Uniformity and accuracy of activities in these labs is determined and maintained by the use of control charts based upon the routine distribution and analysis of uniform national samples by each regional laboratory. Laboratory results are shared with the manufacturers in problem situations.

*Laboratory Services Division* – Agriculture Canada's Laboratory Services Division maintains labs in Calgary and Ottawa. The Dairy Section uses these labs to perform sophisticated tests e.g., pesticides, salmonella and official analyses. All skim milk powder inspection samples are analysed by Laboratory Services Division in Ottawa.

*Certified Laboratories* – As mentioned earlier, skim milk powder grades are determined based upon chemical and microbiological standards. Prior to 1975 all analyses were conducted by Laboratory Services Division. It was realized however, that some independent laboratories could be capable of performing their own tests suitable for grade certificate issuance purposes. A comprehensive laboratory certification program was developed based upon a New Zealand system and was formally introduced in the mid 1970s. It is impossible to provide you with all the details but in general terms labs must possess specified equipment, follow specified analytical techniques, send technicians to a training session and participate in a 60–sample collaborative study prior to certification. After certification, labs must participate in a control chart program and are strictly monitored by analysis of split samples performed by Laboratory Services Division. Laboratories are classified A, B or C and can be decertified at any time.

All the skim milk powder in Canada is now analyzed by 15 "certified" labs. The savings to the industry in reduced storage costs due to reduced turnaround time for receipt of grade certificates (8 days vs 25 days) has more than compensated for the cost of maintaining a laboratory. The program is now being expanded to other dry milk products and evaporated milk.

*Legislation and Labelling* – I have already dealt with Dairy Products legislation but I would like to touch briefly on our labelling program. We operate a centralized non–mandatory label approval system. Manufacturers are strongly encouraged to submit labels to us for approval. This approval provides a degree of protection to the industry should they be confronted with complaints from consumers or other government agencies.

Consumer and Corporate Affairs Canada has delegated the responsibility for the approval of manufactured dairy product labels to us. The result is a one–stop approval service.

A final point regarding legislation relates to the Regulatory Agenda. This document, to which Agriculture Canada provides major input, is published semi-annually as an annex to the Canada Gazette Part I and highlights anticipated upcoming regulatory amendments. Although it is not intended to replace the regular consultative mechanism it is useful in providing advance notice as to future directions.

I have said more than enough concerning our regulation and inspection activities. Before opening the floor to questions, however, I would like to compliment the Canadian dairy industry for its mature and responsible attitude towards regulatory activities. I know of no other industry which has contributed so much to the development of cost effective inspection programs. Only with industry's cooperation have concepts such as Provincial-Federal Inspections, F.O.I.L. and Laboratory Accreditation been able to be implemented. These programs are models for other groups to follow. On the producer side, development and refinement of the supply management system has provided a model for the rest of the world to follow. Last but not least, producer funding of the Dairy Bureau of Canada has helped ensure a bright future for the consumption of dairy products.

We in Agriculture Canada look forward to working with you in your future directions.

# HORTICULTURE AND SPECIAL CROPS SESSION

## Raspberry potential for growth

*C.H. Penner*

Before we examine the potentials for growth, let us briefly review the raspberry industry as it is today. Since B.C., mainly the Fraser Valley, produces 95% of all raspberries grown in Canada, our attention will be focused on the B.C. situation.

The relative importance of raspberries to horticulture in B.C. is illustrated by Table 1.

In terms of World Raspberry Production, Canadian production is insignificant, Table 2.

Ten years ago the B.C. Raspberry Growers' Association was formed with three main objectives in mind:

- To improve the returns to the growers.
- To increase production.
- To develop new products and new markets.

While the association is not taking all the credit for the changes that have taken place in the last ten years, some of these changes are note-worthy.

Prices have improved. While yearly variations still exist, they could be overcome by better marketing techniques. Figure 1 shows the average annual price in relation to the cost of production and the ten year average.

*Production* has increased dramatically. The five year average production 1975–1979, was 14.5 million lbs. In 1983 the production was 30.8 million lbs Figure 2.

*Markets and New Products.* B.C. supplies almost the entire Canadian demand for processing raspberries. However, the domestic demand is not sufficient to absorb the entire production. Hence we must export. During the last ten years we have exported to Japan, Australia and various European Countries. However our most important market is the U.S.A. Because of the economic situation in Europe we have not been able to export to that market in the last few years. Sales to Japan are still relatively small. Because of rapidly increased production, our exports to the U.S. also increased sharply. This caused great anxiety with U.S. producers resulting in anti-dumping action, which they won, with countervailing action, which caused us to withdraw from the B.C. Farm Income Insurance Program, and a non-tariff levy of 1/2¢ per pound on all raspberries stored in Wa. cold storages.

The most exciting and promising activity has been the introduction of raspberry juice. The construction of a modern juice and concentrate plant looks like the answer to our marketing problems. In four short years the distribution of raspberry juice has taken tremendous strides. Already we see more than half a dozen competing raspberry juice labels in the same grocery store.

Canadian and U.S. production and markets of raspberries are so closely linked, that I will combine them for comparing the consumption for the last two years with that of a prior period. Table 3 gives us the apparent disappearance of raspberries from November 1st 1983 to October 31, 1985.

Using the same technology we find that the average disappearance for the five years (1977–1981) was 36 000 000 lbs. That translates to an increase of 60% in four years.

### POTENTIAL FOR GROWTH

1986 promises to be a good year. Poor growing conditions in 1985 (due to drought) are off-set by increased plantings. Cold Storage holdings, though high relative to a decade ago, are down from a year ago. The proven strong demands of the last two years, will have a strong bearing on market activity.

While suitable land for raspberry production is limited, it is quite feasible that total production in the Fraser Valley will increase by 50% in the next decade.

For the foreseeable future our prime market will be Canada and the U.S.A. Aggressive marketing will be required. Increased production must be accompanied by the expansion of the juice market at home and in the U.S.A. Many areas have not yet been reached. We must also increase our fresh and I.Q.F. sales.

It is relatively easy to become a bulk packers of raspberries. It is also easy to export from Abbotsford B.C. to Bellingham Wa., a distance of 50 km. Seattle brokers are all to eager to sell for Canadians, particularly if they shade the price somewhat. Too many novices, all trying to steal a march on their neighbors, will invariably affect the market. A number of large producers have gone into processing and others are planning to do so. They all look at the large U.S. market. Too many berries from too many packers will cross the border. U.S. producers become alarmed, the market softens while Canadian demands for juice–berries are not met. The greatest challenge for the future is disciplined marketing.

TABLE 1.

| Year | Apples | Raspberries | Strawberries | Cranberries | Grapes | Blueberries | Peaches | Cherries | Pears |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | $'000* | | | | |
| 1980 | 28 421 | 7 303 | 8 172 | 4 335 | 6 375 | 4 706 | 5 512 | 5 038 | 4 504 |
| 1981 | 39 459 | 12 837 | 8 310 | 8 115 | 5 808 | 3 819 | 5 545 | 5 765 | 3 687 |
| 1982 | 24 045 | 21 541 | 8 500 | 8 500 | 9 427 | 10 197 | 5 786 | 2 365 | 4 135 |
| 1983 | 32 840 | 14 632 | 11 449 | 11 403 | 8 514 | 7 649 | 3 002 | 3 972 | 2 013 |
| 1984 | N/A | 19 110 | 7 412 | 7 800 | 8 470 | 4 876 | N/A | N/A | N/A |
| Average | 31 191 | 15 085 | 9 145 | 8 031 | 7 709 | 6 249 | 4 961 | 4 535 | 3 585 |

*Statistics Canada (22–003)

TABLE 2. WORLD RASPBERRY PRODUCTION 1983

| Country | Tonnes | % of total |
|---|---|---|
| Canada | 13 000 | 4.9 |
| U.S.A. | 13 000 | 4.9 |
| New Zealand | 1 500 | .6 |
| West Germany | 23 651 | 8.8 |
| Hungary | 20 000 | 7.5 |
| Poland | 29 266 | 10.9 |
| Yugoslavia | 23 321 | 8.7 |
| United Kingdom | 24 000 | 9.0 |
| U.S.S.R. | 100 000 | 37.4 |
| Total | 267 292 | 100.0 |

TABLE 3.

| | '000 lbs* | |
|---|---|---|
| Cold storage holdings of raspberries as of November 1 1983 | 54 500 | |
| Production U.S. & Can 1984 | 55 646 | |
| Total available | 110 146 | |
| Inventories October 31 1984 | 51 000 | 51 000 |
| Production U.S. & Can 1985 | | 48 518 |
| Total available | | 99 518 |
| Inventories October 31 1985 | | 43 000 |
| Disappearance | 59 146 | 56 518 |

*U.S. Statistics Statistics Canada Processors

FIGURE 1

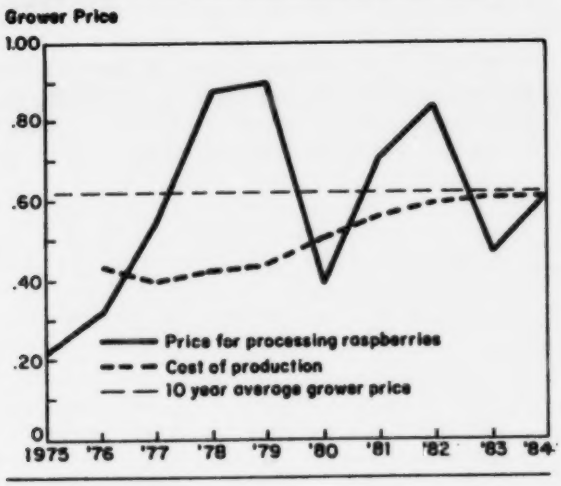
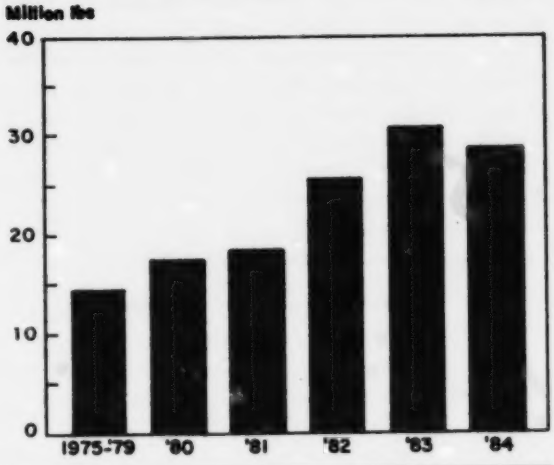



FIGURE 2*




*Statistics Canada

# Storage vegetables – marketing potentials

*F. Sédillot*

The consumption of fruits and vegetables is on the rise in Canada. The general outlook appears quite bright. An automobile purchase can be put off for a year or two, but eating is something we do every day.

In addition, our two largest Canadian cities, Toronto and Montreal, are only a short distance from the truck farming districts of Bradford and Sherrington respectively. Boston, New York and Washington, on the eastern seaboard of the United States, are less than ten hours by truck from the vegetable packing plants in Ontario and Quebec.

I will talk about carrots and onions, since the co-operative I head has been marketing these two vegetables for over twenty years. Our members, in fact, harvest nearly 30 per cent of all onions produced in Quebec.

I spoke just now about the proximity of U.S. markets. Ontario and Quebec can supply New England with vegetables during the summer and even up until winter in some cases. Both provinces are much closer to New England than Michigan and Florida are.

Eastern Canada produces a surplus of carrots, and exports to the United States are essential to ensure good results in 1986 and in future years. American producers, increasingly it seems, consider Canadian vegetables to be the source of their problems. Yet over a twelve-month period, our vegetable imports from the United States greatly exceeded our vegetable exports to that country.

We in Canada will have to ensure that American lobbyists do not succeed in obtaining Congressional passage of protectionist legislation. Such legislation would undoubtedly introduce high import duties and jeopardize our exports of vegetables, especially carrots, to the United States.

It would be foolhardy to let the profitability of our vegetable producers hinge on another drought south of the border or a devastating frost in Florida at Christmas time.

Some minor changes could help our producers break even again. We should study our vegetable storage methods and reduce quality losses resulting from extended storage. We should also review our onion sizing system to ensure that it meets the requirements of the modern Canadian homemaker.

From April to the end of July every year, most of the carrots consumed in Quebec are imported from California via Montreal. Five years ago, a California grower would have received $5 000 for a 50-tonne carload of carrots. Today, he makes not much more. What has changed are freight rates. For example, in 1980, the railways would have charged $5 500 to ship the 50 tonne carload of carrots. As a result of deregulation, they now charge nearly $10 000.

It looks very much as if we are subsidizing American railways.

We must find ways of preserving the quality of stored carrots over a longer period, so that the homemaker does not have to pay too much for vegetables and the producer can benefit from higher prices at the end of the season.

In Europe, particularly in Holland, considerable research has been done on the storage of vegetables. Nuclear technology is one area that has been explored. It would be a good idea to investigate this technology and adapt its application to the numerous specialized storages that were built with government assistance over the last decade.

A few years ago we managed to bridge the gap between the two onion crops by improving our storages. Onion imports during the summer are now almost nil. We will have to make efforts along these lines in the area of carrot marketing.

The onion outlook for 1986 is not particularly bright. High yields were reported throughout North America, and we have had problems exporting to Europe since te United Kingdom joined the Common Market. It is also much more difficult to export to the United States, because of the U.S. import duty of 87 1/2 cents per bag (or $1.21 at the current exchange rate). The duty, plus the fact that Oswego and Orange counties, New York, are closer to a market than we are, mean that our product is not competitive.

Even though onion acreage has remained much the same in recent years, the number of growers has been falling steadily. Several growers have turned to less costly or more profitable types of production, and if the present trend continues, acreage can be expected to decline as well in the years ahead.

Local onion marketing could be improved if the onion grading system were revised.

It is becoming increasingly difficult to sell small onions (1 1/4 to 1 3/4 inches in size), and large quantities are disposed of as culls.

Our chain stores insist on selling small onions in 10–pound bags only. This quantity is too much for an average household, except in September, when the pickling season is in full swing. Lack of space is the reason store managers give for not selling small onions in 2–pound or 5–pound bags.

Since small onions account for nearly 10% of total production, I would suggest that we adopt the same system as that in the United States. There the No. 1 Grade includes onions down to 1 1/2 inches in size, but 40% of the onions of the grade must measure at least 2 inches.

If this system were adopted in Canada, a homemaker would have a wider choice in preparing meals. For some dishes only a small onion is needed. Using half a large onion means that the other half may end up on the kitchen counter and may eventually be wasted.

Since the metric system has not yet been implemented for this type of vegetable, the new sizing standards could be introduced when conversion takes place.

The proposed changes would also benefit producers. An additional cent of profit on every 2–pound bag would increase gorwers' incomes by $10 million.

While weather conditions will continue to be the main unknown factor in agriculture causing large price swings, we must always think of consumers and offer them a top–quality product.

# Resources for the future – resource requirements for expansion of fruits and vegetables

*D. Dempster*

At the very outset, I would like to indicate that I intend to offer a rather macro view of what I feel are essential elements in any future in which the Canadian industry can potentially expand, some might say maintain, their level of production of fresh and processed fruits and vegetables. My observations are based on my experience or understanding of the evolution of the industry since the mid-seventies, my perspective of some of the competitive players in our domestic and traditional export markets, and my observations of the attitudes of both our own Canadian government (not necessarily Agriculture Canada) and other countries towards agriculture. in this latter area I must sincerely state that there is either a very poor or naive understanding of the complexities of agriculture and the forces that exert such a strong influence over Canadian agricultural returns. These forces include current government policies, or non policies if you like, and the competitive influence of foreign suppliers both here and in our export markets.

Before forecasting what the future may hold, it may be interesting to focus in or where we are in 1985, and where we have come from.

The profile of our industry in 1984 shows farm gate production based at $1.106 billion, up markedly since the last decade. Exports have grown from $155.6 million in 1978, to $352.8 million in 1985. The major growth in our exports, of course, has been to the United States. For those who do not put things in perspective, you could read these figures and deduce we are excelling and indeed highly profitable– unfortunately, many in government think we have it made. However, they do not understand that net incomes in our industry, in the very best years, rarely exceeds a 5–6% return on investment – hardly what many Canadians accept or expect for their money. Our increasing efficiency in producing units per hectare, has allowed us as farmers to exist and indeed survive on minimal negative commodity price increases. Unfortunately, I believe D-day has arrived for many of our farmers. Fortunately our industry has by and large not regressed as much as others.

To add to these previous comments, one must recognize that our $200 million growth, in exports mostly to the U.S.A., has been aided immeasurably by the relative values of our two dollars – 1978 was the last year we had parity. Interestingly in this corresponding period, imports of fruits and vegetables (including wine) have grown $824 million or four times as much – many of these products are of a class or kind grown or processed here. Coupled with this one must add tremendous per capita increases in consumption of fruits and vegetables due to consumer demand. One could ask, how well have we really done and how much has the strong U.S. dollar affected our exports? What would happen if parity returns, do we lose our U.S. export markets and do imports increase to Canada where we face serious geographic, climatic and cost disadvantages?

The purpose of the foregoing was not to appear negative or set an ominous stage. It was merely to direct your thoughts as to how we have really fared and what in fact may lie ahead for us as an industry and what must be done.

Before I start into resource requirements for a realistic expansion of our industry, I would like to indicate that I see that it will not be a list that is meant to be exclusive of one another. Moreover, there are a combination of factors required between both government and industry – the failure of one party to act will render any efforts by the others to be much less effective. I will attempt to categorize them in a list form with reference to who holds the major responsibility and the involvement of the other party. I will attempt to put them in some sequence such that if you don't address the first, throwing dollars or effort at subsequent areas is meaningless. Correspondingly, if the other elements are not addressed adequately, it renders the first steps as sound, but useless efforts.

## PRODUCTION

- Increased research – public and private into new commodities, varieties, product lines – extension of season, shelf life, etc. – Require federal research resources. Increased projects matching public/industry monies to meaningful research (technology transfer) i.e. N.C.D.F.

- Increased attention to soil conservation – federal and producer challenge.
- Sound phytosanitary environment to en-sure export potential – sufficient resources for government regulatory function.
- Chemical registrations – increased resources to ensure adequate, safe chemi-cals are available to Canadian producers, perhaps through N.C.D.F. – greater federal resources.

## LABOUR AND MECHANIZATION

- Effective programs to supply skilled and unskilled labour to producers at compe-titive rates (competitive to our competitors costs) – federal/provincial and producer challenge.
- Realistic support regulations – government.
- Improved mechanization – industry and government research.

## PRODUCT TREATMENT

- Greater attention to quality, hydro–cooling, vacuum cooling, packaging & presentation, storage–major industry challenge, stricter standards, government enforcement – perhaps government assistance to help offset technology costs.

## TRANSPORTATION

- More timely cost effective long distant transportation
- Improved equipment and containers

## MARKETING

- More promotion of "Canadian" products; emphasis on Canadian abroad – federal and producer responsibility.
- More effective marketing through greater cooperative efforts, or allow the strong to survive.
- Greater information to buyers, continuity of supply.

## GOVERNMENT PROGRAMS

- More effective trade instruments to offset distress priced selling in Canada.
- Tri–partite stabilization plans.
- Farm credit assistance.
- Government assistance in exporting – credit lines, promotion, storages overseas, breakdown on non–tariff barriers.

Government to address legislation impacting on our cost structures and take steps to either reduce or offset them through protection or assistance, e.g. taxation, social programs, hydro, etc.

I have expanded the original subject much beyond the normal perception of resources (e.g. water, soils). By and large, we have the essential agreements. In particular, in Section I we can take pride that we have excelled as a country, although we must ensure we don't reduce our attention to these matters. In the other areas, there are examples of excellent industry and government efforts. However, we have been quite weak in many other areas, notably sections III, V and VI. By and large sections II and IV are more general government strategies which have in part limited our ability to meet all of the challenges; efforts must be expended in these areas.

In conclusion, I hope I have fulfilled the original objectives of my presentation, although I did stray from the term resources in the traditional sense. However, these exist as the challenges as I see them. If we are to meet the objective of expanding our industry for the domestic and export markets, most or all of these challenges must be met. Until government and industry alike take a realistic look in the mirror as to what each has done, or can or should do; I seriously question if we can meet the challenge – if our dollar strengthens noticeably, I would respectfully suggest the situation will deteriorate.

# Commodity councils for growth – apples

*L. Hennigar*

Expected market strengths and weaknesses facing producers in the near term and in the future five to ten years.

Before anyone can talk intelligently about the future trends facing producers, a trip back through history can yield some valuable lessons. Fifty years ago, apple sellers in Canada held an edge on other parts of the world, because we were closer to our markets than the competition. The Eastern half of Canada shipped a large percentage of their crop to the U.K. and Europe, as well as into the U.S. and enjoyed an advantage over the rest of the world in that we were preferred trading partners with the U.K.. The Western part of Canada had their markets locally and into the U.S. and further afield to the Pacific rim countries. It seemed that, aside from purely regional difficulties, apple producers had a ready market for their product, although when one reads annual reports of years gone by, there always seemed to be the recurring problem of not enough return from their product to cover all the costs going into the production of the apples.

In the late 60s and early 70s production began to increase in Canada, due to new plantings and the use of size controlling roostalks, and at the same time production on the world scene increased at a rapid rate. This tremendous increase from many parts of the world and the significant increase in the ability to transport from one country to another, soon led to an overproduction on the world markets. Canadian producers had also been increasing their production at the same time and soon found themselves trying to compete in a market place that suddenly had become oversupplied and undervalued by fruit that was being produced cheaper than Canadian fruit. This was, to my mind, due to our Government imposed increase in wages and the tremendous influence that very high inflation rates had on the producers input costs. Added to this was the fact that the Governments in other countries did not hesitate to put in place very high levels of support to their fruit producers to help them compete on the international markets. At the same time, the European Economic Community came into being and very dramatically shifted the established pattern of trade which had been enjoyed between those countries and Canada, not only in the fresh market, but much more significantly in the market for our processed apple products.

In order to overcome these disadvantages, our Government kept influencing the producers to intensify their plantings and to become more efficient in their production techniques. This was done over a number of years, at a large cost to the producers and as a result that at the present time, I feel that Canadian apple producers are now poised on the brink of a situation that will either make or break the apple industry in Canada within the next few years. We have increased our production by way of increased plantings of more highly colored strains of apples on rootstalk that are increasing our production per acre to the point that we could with the help of Mother Nature, have a production year that will cause many, many headaches and problems. Witness what is happening this very year with just a small increase in production that has taken place. At some year in the near future, when all inputs combine to allow optimum production in all apple growing areas of Canada, we will be faced with a crop that, to my unskilled eye, will not be able to be marketed within the present marketing parameters.

This morning I have been asked to address you on the "expected market strengths and weaknesses facing producers in the near term and future five to ten years". First, in random order, let us look at a few of the market weaknesses facing producers in the near term.

Lack of any kind of Canadian organized marketing effort. Every apple growing area in Canada is an entity unto themselves and work in opposition to the other apple growing areas in the marketing of their respective crops. It has been tried, through Canadian Horticultural Council and the Fresh for Flavour Foundation, to carry on a Canadian apple promotion. This was done for a few years, mainly because the Federal Government put up matching funds, but during the past few years, this promotion has not been carried out because the producing areas could not agree to funding of the program and because it was very strongly felt that if the promotion was to be carried out it had to be a truly Canadian promotion, with all producing areas taking part. Each area has their own promotions with no thought to co-ordinating them into a Canadian

wide promotion. We need to make the people of Canada aware that we have a good, nutritious product available to them and we need to promote it to keep our market share and we need to do it together.

Another weakness facing producers is the lack of organized marketing effort to one degree or another within the individual apple growing regions:

N.S. has a very disjointed marketing effort. The Nova Scotia Fruit Growers Association is trying to carry out a promotion program on behalf of the members of the organization, but as seems to be true in other producing regions as well, the Association does not have the support of all the producers in the area. A few pay for programs that benefit all. I think it is quite fair to say that N.S. producers do not want to organize their marketing efforts at this point in time, although there is a concerted effort to have a unified approach to our offshore marketing through a single brand denoting quality.

N.B. seems to be the most successful thus far in their approach to organized marketing. However, they are unique in that they are very rarely concerned with exporting any product outside their Provincial borders growing regions and their wholesalers tend to be very loyal to the N.B. producers.

Quebec has tried their hand at organized marketing but without continued support from their producers it does not seem that it will achieve its desired purpose. There is a move afoot at the present time to carry out a promotion of a quality brand supplied by packers who are willing to follow guidelines laid down and make it available to the large supermarkets in Quebec.

Ontario has had moderate success with the Ontario Apple Marketing Commission, and probably this present year will determine how much influence it has on holding producers to a set price.

British Columbia seemed to be the leader in this field for many years but looking from outside in it appears that some of the producers are having second thoughts about continuing to belong to the B.C. Tree Fruits Organization. Again B.C. grows more apples than they can consume and so find it necessary to export the major portion of their crop.

Organized marketing is a must if the producers within Canada want to have any say in the viability of their industry.

Overproduction is the third market weakness facing producers in the near and long term – not only Canadian production but worldwide production. Over the past years of increasing production we, as producers and marketers have not increased storages and marketing expertise to handle the large crop that could be on our trees at any time in the very near future. All we have to do is look at the problems that have occurred this year with a slight increase in the crop in Ontario and Quebec and we can very readily see the problems that will face us in a large crop year. What happens to our markets when there is a larger than normal crop year? First of all, there will be a lack of storage space available to store the crop because we have not built enough storages, both cold and controlled atmosphere, to handle a 30 million bushel crop in Canada. With the lack of storage, producers *must* sell a portion of their crop on the markets within a very short time so as to realize some return from their produce. This means that fruit is unloaded on the local and export markets at prices that do not even recover the cost of production, because, try as we might, it is very difficult to keep the information from the press and the wholesalers attention that there is a large crop to be sold. With fewer and fewer buyers, it is not difficult to understand that they realize the situation that the producers are in and the fact that there will be more than the usual amount of fruit being offered to them and, as a consequence, the price is very low for the first part of the season in a large crop year. The observation has been made many times, that once a low market price for any product is established, it is very difficult to increase the price when storage holdings and market conditions return to normal. It seems to be a lot easier to lower a price on the market than it is to get the price back up after it has been lowered! There is a very real need to have our storages modernized and our storage capacity increased, so that as production increases, we, as producers, will not be in the position where we have to sell a portion of our crop in a very limited time frame.

The Federal Government began an Advance Payment For Crops program a few years ago and this has been very beneficial, in that it supplies cash flow at a critical time in the financial program of the producers and does help them to hold part of the crop until there is better prices but, in my opinion, it does not answer the complete question. Producers need more and better storages, but market returns do not

generate the retained earnings needed to build these sophisticated and expensive buildings for storage. The Federal Government Fruit and Vegetable Storage Assistance program has been a much needed program in the past, but I feel very strongly that it will be needed even more so in the future. It is essential to have adequate storage facilities in place *before* the large crops predicted for future years actually become fact.

Coupled with the expected increase in production in Canada over the next ten years, that great neighbour to the south, the U.S.A, must also be taken into account when we talk about market strengths and weaknesses. Whether we want to acknowledge it or not, they are a very important consideration in our market returns for any given year. The one fact concerning the production of fruit in the U.S. that startled me the most was about four years ago, when it was reported that the apple production in Washington State was increasing 10% that year – and that the *increase* in the crop for that one State was equal to the entire Canadian production of apples for the year!

It is an acknowledged fact that the price paid to producers for their fruit in the U.S. has an extremely important bearing on the price paid to the Canadian producers. It is a very short truck route between the major growing areas of the U.S. and the major growing areas of Canada. The price for apples in Washington State affects the B.C. grower price; Michigan certainly influences the price in Ontario; upper New York State is not that far from Quebec; and the Eastern seaboard of the U.S. has a lot to do with setting the price in N.B. and N.S.

Production in the U.S. cannot be controlled by anyone in Canada, but it must be taken into consideration when making plans for marketing over the next ten years. How it will affect the producers in Canada over that period of time will be determined by climatic conditions, economic conditions and the outcome of talks between Canada and the U.S. on free trade, freer trade, enhanced trade or whatever it will be called.

Free trade is a topic that is making the headlines in the newspapers on a daily basis, and it is going to be a very important consideration of the fruit industry of Canada in the near and the long term future, and will certainly have an effect on the marketing of fruit in Canada. At the present time we, as producers, do not have a clear idea as to what is being proposed for free trade, but it is a subject that needs our careful attention and input over the next period of time. There is free trade now in the fresh apple movement between Canada and the U.S. and limited free trade in the processing sector of our industry, but we must make sure that we study all implications of free trade and what the result will be on our industry, and make sure that the information is conveyed to the appropriate Government personnel who are involved in the ongoing negotiations with the U.S.

One of the very real marketing weaknesses facing producers now and in the next ten years is our method of moving our product through the distribution chain from the packing house to the consumer. We have used, and continue to use, a package for the majority of our product that to my mind is the poorest container that could be used. I refer to the much maligned *poly bag*. Producers realize that it is the poorest containers available to ship apples in, but because of the lower cost involved and the continued call for a low priced product from the wholesale trade we continue to use it and put up with apples being bruised, abused and maltreated. Emphasis needs to be put on the development of a reasonably priced alternative to the poly bag to enable the producers to get their product into the hands of the consumer without the usual deterioration in quality associated with the poly bag. We must keep the price of our product to the consumer on a competitive basis but we must be able to deliver that product in a manner that maintains the quality that the consumer demands.

One point that I touched on earlier as a market weakness facing producers was that the buyers keep decreasing in numbers and the sellers keep increasing in numbers. This inevitably leads to a decrease in the influence that producers have in the pricing of their product. Too many sellers and not enough buyers leads to a disorganized market system and lower returns to the producer. We need to have more say in the price received from markets and to this end there is a real need for organized marketing on the part of the producers. Even with the weaknesses associated with organized marketing systems in place today, the industry would be in much worse shape that it is, if these systems had not been put into place. There now needs to be a refinement of the systems to make them work more efficiently. Overall though, there must be a commitment on the part of the producers to work together and realize that their future wellbeing rests, not in individual effort and competition, but in the

combined efforts of everyone interested in the marketing of fruit, from the producer, to the packer, to the wholesaler, to the retailer and ultimately to the consumer to get a fair return to the producer for his work involved in producing the fruit.

To this point in time, I have been addressing the fresh marketing of apples. There is another segment of the fruit industry of importance to the producer and that is the processing sector. Processing continues to be a weak point from the standpoint of the producer. Sales to processors over the past number of years, and into the foreseeable future, have rarely, if ever, returned cost of production to the producer. Processors too are in a difficult position as they are facing world competition and cannot stay in business if they do not make a profit. Processors cannot pay as much as is needed to offset the producers production costs. It is very important that the Commodity for Growth – Processing Sector work that has been done be carried on in the future and recommendations carried forth to the Federal Government as soon as possible. It is also very important that the Federal Government recognize the importance of the horticultural industry to the Canadian economy and be prepared to assist it both financially and with manpower over the next number of years. Processing is a market weakness to the producers over which the producer does not have any control.

So far, I have concentrated on market weaknesses and expected market weaknesses facing producers, but I am also expected to say something on market strengths facing producers. There are times, I must confess, when I wonder if there are any market strengths facing producers at the present time or over the next ten years. But, since I am an apple producer, and there is some indications of the fact that I have a son who is interested in continuing in this business of growing apples, then I must show some optimism for the future of the apple industry in Canada. We as producers do have some definite strengths which will help us to compete in the marketplace over the next few years.

There is a trend towards new apple plantings in Canada, the majority of which are on size controlling rootstalk. These plantings are increasingly giving better quality fruit, both from the standpoint of size and color. The smaller trees are increasing the efficience with which producers can grow apples, and with the very narrow, or nonexistant, profit margins in the industry today, every advantage that can be gained is an added strength to the producer. We must continue to increase our efficiency in producing top quality apples for sale on the fresh markets, as there certainly is no money in growing apples for juice. We must continue to increase our new efficient plantings and replace our old, inefficient trees.

Another of our market strengths, and this I alluded to in the market weaknesses, is the trend towards more organized marketing in the various regions of Canada. By organized marketing, I mean not only marketing boards and commissions, but organized promotion of quality fruit under a brand name. This trend has already begun with Quebec producers working on a joint effort to promote quality fruit to the supermarket chains and Nova Scotia producers discussing the possibility of marketing a quality brand on the local market under the direction of the Nova Scotia Fruit Growers Association. Producers are realizing that there has to be some kind of organized marketing in order to realize greater returns from the marketplace.

Another market strength or opportunity facing producers is the trend towards increasing consumption of fresh apples. The population of Canada continues to increase and it is a priority of the producers to explore the possibility of reaching the new consumers and also the present consumers with the idea to increasing consumption. We have a good product that has definite nutritional value and as such we should be promoting these benefits to the general public.

Thus far I have not mentioned another very important market strength facing the producers and that is the ability to compete on the export market with our apples. Canada has some excellent growing areas for the production of quality MacIntosh. There is a place for quality fruit in the offshore market and I feel that there is room for expansion of our efforts in that direction. The market is there and we can supply it, but so often in the past, the export markets have been used as a place to move our surplus apples rather than treat it as a consistent market. This makes it frustrating for the foreign brokers who are trying to provide a consistent supply to their customers. As production increases in Canada there will be more and more need to move our fruit out of the local markets into the export markets and we must begin to accomplish this now.

This morning I have been asked to speak on the market strengths and weaknesses facing Canadian apple producers in the near term and in the future five to ten years. You will have noticed by now that I have not said much that you have not already heard of or known from your own experience. I believe that we have some very long hours of work ahead of us to exploit our market strengths and to overcome our market weaknesses and I am firmly convinced that the only way that we can hope to overcome our weaknesses is to continue to work together for the future benefit of the apple industry in Canada.

# FARM COSTS AND INCOME SESSION

## Provincial farm income situation and outlook[1]

*Wayne Jones and Jean Miketinac*

### INTRODUCTION

Thank you Mr. Chairman. Good morning Ladies and gentlemen.

Yesterday at this conference we heard that, at the national level, following the record high level of farm income in 1984, realized net farm income was forecast to decline by 14% in 1985 and then rise again in 1986.

My task this morning is to look at the provincial income forecasts that go into making up this national scenario. First I'd like to acknowledge the assistance of the Agricultural Division of Statistics Canada and the provincial Ministries of Agriculture in the preparation of this forecast.

My presentation this morning will be in two parts. The first part will be to look at the provincial forecasts which entails cash receipts, farm expenses and realized net farm income. The second analyzes some of the structural characteristics of the agricultural economy by province. These characteristics tend to suggest that some provinces are more sensitive to income fluctuations than others.

### CASH RECEIPTS

I will first discuss cash receipts which include government program payments. Table 1 indicates that 1985 cash receipts are forecast to decline in all provinces except Newfoundland and Nova Scotia. However, the downturn in cash receipts is expected to be modest in most provinces. The largest declines for 1985 are expected in Prince Edward Island, Ontario, and Saskatchewan. While cash receipts are down from last year they remained above the pre–1984 levels in all provinces. The outlook for 1986 is somewhat more favourable. Gains are expected in all provinces except Saskatchewan and Alberta where cash receipts are forecast to drop to their lowest level since 1980. In the other provinces 1986 cash receipts are generally the highest on record if our forecast is on target.

Looking at some of the highlights affecting the 1985 cash receipts; for the second straight year there was a drought in western Canada which affected both grain production and crop quality. We saw record wheat, corn, and soybean production in the east, although prices were somewhat depressed. Excess supplies reduced potato prices across the country. Weak markets sharply reduced tobacco and sugar production. Generally favourable fruit and vegetable prices and good crops benefitted producers in Ontario, B.C. and the Maritimes. There was further cattle herd liquidation, particularly in the west, in response to feed grain shortages brought on by the drought. There were also substantial government program payments in the form of market support, disaster relief, and input subsidies or production support. These payments for 1984 and 1985, which include both provincial and federal programs, can be seen in Table 2. Market support includes such items as Western Grain Stabilization and Agricultural Stabilization Act payments, provincial income stabilization programs, dairy subsidy payments, etc. Disaster relief includes such items as Crop Insurance, and provincial emergency relief assistance. Production support consists of subsidies such as fuel and interest rate rebates, and feed assistance. The total for 1984 was about $1.4 billion in direct provincial and federal producer payments. This increased to over $2.1 billion in 1985.

Looking at some of the highlights for receipts for 1986 we're expecting increased grain marketings due to low deliveries this fall on account of the late harvest, and increased production next year. This assumes that there is a return to more normal crop conditions in the West. We are predicting lower corn and soybean production in response to lower prices. We also expect some strengthening in potato prices as inventories decline and there is some increased activity on the processing side. Increases in tobacco marketings in 1986 are expected as buyer inventories return to more normal levels. Higher beef and hog prices should boost livestock

receipts, particularly in Ontario and Quebec where the herd size is much larger. Based on the low grain receipts this year there is likely to be a Western Grain Stabilization payment next year. And finally, there should be some additional drought assistance in the West from programs that have already been announced this year but have cary-over payments for 1986.

## FARM EXPENSES

Turning to farm expenses which include operating expenses and depreciation charges, Table 3 indicates that we are expecting only modest increases for 1985. As a matter-of-fact, except for Newfoundland, the expenses have risen less than the general rate of inflation of about 4% this year. One point of interest is that lower depreciation charges, which are due to lower levels of investment in the last few years, have been a major factor in the dampening of total farm expenses. In four provinces, British Columbia, Ontario, Quebec, and Nova Scotia, farm expenses are forecast to decline slightly in 1985 with decreases in both the cash expenses and depreciation charges.

In 1986, most provinces are expected to show a decrease in farm expenses which will result in the first decline in total farm expenses at the national level since 1957. Those provinces where farm expenses are expected to rise modestly in 1986 are Newfoundland, Prince Edward Island, and Manitoba. In fact, these increases are well below the forecast rate of inflation of 3.3%.

Influences on the 1985 farm expenses include lower interest rates which have a significant impact on interest expenses. The impact is immediate because we estimate 60% of all farm debt is written on a floating-rate-of-interest basis. Also, there was reduced credit activity in terms of additional borrowings which resulted in very little increase in the total farm debt in 1985. We saw somewhat higher fuel prices due both to market and regulatory factors. A pesticide expense rebate was introduced in Alberta this year in the fight against grasshoppers. In Saskatchewan, there was an elimination of the small property tax on both farm land and urban residences. There were somewhat lower feed prices except in the drought area of western Canada. We saw an increased utilization of fertilizer due to both increased crop areas and higher application rates.

The 1986 farm expense forecast is influenced by an expected further decline in interest rates. Saskatchewan has recently announced an interest rate reduction program. Fuel rebate programs have been introduced in Saskatchewan and Alberta. We expect somewhat lower land rental rates due to low grain prices and possibly some increase in the amount of land available for rent. We are forecasting a further reduction in depreciation charges due to continued low levels of farm investment and a small build-up of capital stock on farms.

## REALIZED NET INCOME

These modest changes that I have just gone over in terms of cash receipts and expenses will have a significant impact on net income. In general, a small change in cash receipts and farm expenses translates into large changes in net income due to the magnitudes involved. Thus our forecasts today of slight decreases in 1985 cash receipts and slight increases in 1985 expenses result in a sharp drop in realized net income for 1985.

Table 4 indicates that all provinces experienced declines in realized net income in 1985 except Nova Scotia. The hardest hit provinces are Prince Edward Island, Ontario and Saskatchewan where realized farm net income is forecast to be well below the average income for the 1980-84 period.

Thankfully prospects are much better for 1986 with realized net farm income expected to increase in all provinces except Alberta and Saskatchewan where the effects of the 1984 and 1985 droughts are still in evidence. The strongest gains for 1986 are forecast for Ontario where realized net income is expected to increase by some 32% in 1986. Again, this large increase shows the sensitivity of farm net income. We are predicting that cash receipts will increase by 5% while expenses will drop by only 1%, however, that is sufficient to increase realized net income by 32%.

## FARM INCOME SENSITIVITY

Now I would like to look at some of the structural characteristics which I believe suggest that some provinces are more sensitive to income fluctuations than others. That is, a drop in farm income may have a more serious impact on the farm economy in some provinces than in others.

Table 5 shows the average level of assets per farm, based on averages for the 1981–83 period. The value of assets range from about $170 000 per farm in Newfoundland to well over $600 000 per farm in Alberta. The larger and more capital intensive agriculture of western Canada is evident from the high average asset values in the prairies.

Capital investment and asset values are influenced by the rate of return to these assets. The return to assets is simply that proportion of farm income that can be generated by the productive use of these assets. in general, the rate of return to assets tends to be lower where farming is more capital intensive. I think there may be diminishing returns to capital investment at play here. When returns are low, investment and asset values will tend to be more sensitive to income fluctuations in the capital intensive regions. Thus periods of low income, such as those we've seen since 1981, are more likely to have an adverse effect on investment levels and asset values in the capital intensive western agriculture.

These same high capital requirements also increase financing needs and therefore result in higher debts loads. Total debt per farm is much higher in some provinces and again the highest debt per farm is in the West as can be seen in Table 5. These higher debt levels imply that a greater proportion of farm earnings are required to service debt in terms of interest expenses and principal repayment. This means less money leftover out of farm income for family consumption and reinvestment in the farm. Thus in those provinces where average farm debt is high, particularly in western Canada, income fluctuations are more likely again to create cash flow difficulties which can lead to problems of loan arrears, refinancing needs and possible foreclosure actions.

Table 5 also shows average income margins for the 1981–83 period. This is perhaps an unfamiliar concept but it is essentially just a measure of income as a proportion of farm receipts. As such, it is a rough proxy for profitability. Differences in these income margins are generally attributable to the different commodity mixes in the provinces and a different combination of factors of production. By way of illustration, an income margin of 0.2 implies that $10 of cash receipts generated by farm production will return $2 of farm income. We see here that the lowest margins for the 1981–83 period were in British Columbia and Manitoba and the highest margins were in Saskatchewan and Prince Edward Island.

The higher the income margin the higher should be the resiliancy to income fluctuations, in that there exists a greater margin for adverse changes in receipts or expenses before income tends towards zero or becomes negative.

Finally, I would like to look at the provincial differences in total income per farm. By this I mean the combination of income generated by the farm operation plus off farm sources of income. The data in Table 6 show that farm income accounted for about 64% of total income per farm over the 1981–84 period at the national level. I should mention that these figures include only the income of the farm operator and not off-farm income contributions of the spouse or other family members.

Provincially, farm income as a proportion of total income ranged from 46% in British Columbia to 74% of total income in Quebec. What this means is that, on average, in British Columbia, a farm operator relied on his farm to generate 46% of his total income. Whereas in Quebec, on average, for the 1981–84 period, an operator relied on farm income to provide 75% of his total farm income.

Provinces with a greater dependency on farm income do not necessarily have a higher (or lower) total income level as shown by the right hand column in Table 6. It is clear, however, that provinces more dependent on farm income for contributions to total income would be more vulnerable to changes in farm income. Based on the 1981–84 period, the most vulnerable provinces according to this measure would be the eastern provinces.

These structural characteristics – level of investment, debt loads, income margins and off-farm sources of income – all affect the sensitivity of the agricultural sector to fluctuations in farm income and vary considerably from province to province. This fact should be kept in mind when assessing the impact of the current farm income forecasts on the provincial farm economies.

[1] This paper has been revised from that presented at the Outlook Conference to incorporate more recent information.

## TABLE 1 FARM CASH RECEIPTS, 1984–86

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | – millions of dollars – | |
| Newfoundland | 41.5 | 41.7 (+0.5)[a] | 43.2 (+3.6) |
| Prince Edward Island | 192.6 | 181.3 (–5.9) | 187.2 (+3.2) |
| Nova Scotia | 256.5 | 259.3 (+1.1) | 265.7 (+2.5) |
| New Brunswick | 227.9 | 220.5 (–3.2) | 227.7 (+3.3) |
| Quebec | 3 053.2 | 3 003.2 (–1.6) | 3 076.4 (+2.4) |
| Ontario | 5 337.0 | 5 117.1 (–4.1) | 5 370.4 (+5.0) |
| Manitoba | 1 942.7 | 1 935.3 (–0.4) | 2 042.2 (+5.5) |
| Saskatchewan | 4 357.7 | 4 189.7 (–3.9) | 3 992.7 (–4.7) |
| Alberta | 3 944.6 | 3 818.9 (–3.2) | 3 647.3 (–4.5) |
| British Columbia | 962.0 | 957.0 (–0.5) | 974.9 (+1.9) |
| Canada | 20 315.7 | 19 724.1 (–2.9) | 19 827.9 (+0.5) |

[a] bracketted items refer to percentage change relative to the previous year.

## TABLE 2 GOVERNMENT PAYMENTS

| | 1984 | 1985 |
|---|---|---|
| | – millions of dollars – | |
| Market Shortfall | 766 | 1,080 |
| Disaster Relief | 338 | 653 |
| Production Support | 320 | 387 |
| TOTAL | 1 424 | 2 120 |

## TABLE 3 FARM OPERATING EXPENSES AND DEPRECIATION CHARGES, 1984–86

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | – millions of dollars – | |
| Newfoundland | 31.0 | 32.4 (+4.5)[a] | 32.5 (+0.3) |
| Prince Edward Island | 143.2 | 148.4 (+3.6) | 148.6 (+0.1) |
| Nova Scotia | 200.9 | 199.2 (–0.8) | 198.3 (–0.5) |
| New Brunswick | 171.9 | 173.7 (+1.0) | 173.1 (–0.3) |
| Quebec | 2 321.0 | 2 285.3 (–1.5) | 2 266.5 (–0.8) |
| Ontario | 4 266.0 | 4 243.9 (–0.5) | 4 196.9 (–1.1) |
| Manitoba | 1 622.1 | 1 657.6 (+2.2) | 1 677.0 (+1.2) |
| Saskatchewan | 3 316.3 | 3 400.3 (+2.5) | 3 347.3 (–1.6) |
| Alberta | 3 354.6 | 3 294.5 (+1.8) | 3 184.4 (–3.3) |
| British Columbia | 818.6 | 816.2 (–0.3) | 814.0 (–0.3) |
| CANADA | 16 245.8 | 16 251.5 (+0.03) | 16 038.7 (–1.3) |

[a] bracketted items refer to percentage change relative to the previous year

## TABLE 4 REALIZED NET FARM INCOME, 1984–86

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| | | – millions of dollars – | |
| Newfoundland | 11.0 | 9.9 (–10.0)[a] | 11.4 (+15.3) |
| Prince Edward Island | 52.3 | 35.8 (–31.5) | 41.4 (+15.6) |
| Nova Scotia | 61.7 | 66.3 (+7.5) | 73.7 (+11.1) |
| New Brunswick | 60.1 | 50.7 (–15.6) | 58.5 (+15.4) |
| Quebec | 790.6 | 776.4 (–1.8) | 869.5 (+12.0) |
| Ontario | 1 141.1 | 940.1 (–17.6) | 1 242.0 (+32.1) |
| Manitoba | 339.8 | 295.1 (–13.2) | 382.8 (+29.7) |
| Saskatchewan | 1 081.9 | 830.2 (–23.3) | 686.0 (–17.4) |
| Alberta | 629.0 | 563.6 (–10.4) | 502.2 (–10.9) |
| British Columbia | 166.5 | 163.1 (–2.0) | 183.4 (+12.4) |
| CANADA | 4 334.0 | 3 731.0 (–13.9) | 4 051.0 (+8.6) |

[a] bracketted items refer to percentage change relative to the previous year

## TABLE 5 TOTAL ASSETS, DEBT AND INCOME MARGIN PER FARM, 1981–83 AVERAGE

| | Total assets per farm | Total debt per farm | Ratio of realized net income to cash receipts |
|---|---|---|---|
| | – dollars – | – dollars – | |
| Newfoundland | 168 838 | 24 911 | 0.20 |
| Prince Edward Island | 219 910 | 42 900 | 0.25 |
| Nova Scotia | 178 934 | 38 719 | 0.21 |
| New Brunswick | 165 026 | 45 244 | 0.25 |
| Quebec | 204 072 | 56 120 | 0.23 |
| Ontario | 370 709 | 60 945 | 0.18 |
| Manitoba | 340 002 | 57 169 | 0.15 |
| Saskatchewan | 486 400 | 58 822 | 0.26 |
| Alberta | 636 634 | 78 535 | 0.18 |
| British Columbia | 413 394 | 71 177 | 0.14 |
| CANADA | 410 680 | 62 464 | 0.20 |

## TABLE 6 TOTAL NET INCOME PER FARM, 1981–84 AVERAGE

| | Farm income as % of total net income | Total net income |
|---|---|---|
| | – percent – | – dollars – |
| Newfoundland | 72.4 | 15 033 |
| Prince Edward Island | 74.8 | 19 022 |
| Nova Scotia | 64.4 | 16 627 |
| New Brunswick | 68.3 | 17 095 |
| Quebec | 75.1 | 17 345 |
| Ontario | 63.1 | 17 169 |
| Manitoba | 61.1 | 14 064 |
| Saskatchewan | 68.1 | 21 271 |
| Alberta | 57.4 | 18 604 |
| British Columbia | 46.2 | 15 467 |
| CANADA | 64.0 | 17 969 |

# The farm management input and structural change in modern agriculture

*P. Ehrensaft and R.D. Bollman*

## INTRODUCTION

Farm enterprise organization and the farm management process are now poised between two agricultural revolutions. The adoption of petro-chemical-intensive agricultural technologies and intensified genetic selection provided the technical basis for the rapid decline of the farm labour force from 25 percent to 4 percent of the economically active population between 1945 and 1970. A long period of expansion in the world economy, low real interest rates, and relatively open patterns of international trade provided the macro-economic context for the transformation of farm structure and agricultural policy.

Agriculture passed through the "stagflation" of the 1970s with more ease than most other sectors: booming grain prices and land values meant that real interest rates for farmers were low despite double-digit nominal rates. The post-1981 declines in grain and red meat prices, however,coupled with rising real interest rates and accumulated debts from the expansionary context of the 1970s, created the most difficult years for farmers since the Great Depression. Drought in the North American plains may be the harbinger of climatic instability brought about by both long-term weather cycles and industrial pollution. At the technical level, the rate of increase in multifactor productivity slowed down during the 1970s; incremental improvements of existing technologies became the predominant trend in the creation and diffusion of innovations.

A new "epoch-making" phase of technological change, to borrow Joseph Schumpeter's terminology, is now clearly on the horizon for agriculture. Commercial applications of biotechnology are likely to become widely available during the 1990s. The preliminary stages of the applications of micro-electronics to control agricultural production are now in place. In terms of the macro-economic and institutional context of the 1990s, we do not profess to have a crystal ball which can predict whether the relative expansion and openess of the 1945-70 period will reappear. We do advance the hypothesis that the last decade of this century will witness a new phase in the structural transformation of agriculture as profound as the changes which ensued in the decades following World War II.

Our strategy for analyzing the management challenges for a farming system in transition between two agricultural revolutions is to focus on the leading edges of structural change in recent decades: the newer or "non-classic" forms of farm enterprise organization are already important and will become more so during the next epoch-making phase of technical change. The analysis proceeds by asking three questions about farm management: 1) What types of farm enterprises must be managed? 2) Who are the people who manage these enterprises? 3) What are the tasks confronting the managers of newer forms of farm enterprise organization in a complex and volatile macro-economic context. We shall argue that farm families rather than "the Farmer" or farm operator constitute the relevant unit for understanding management decisions and the role of the farm family as a whole is enhanced in most enterprises which surpass the scale of the classic family farm. Farm management increasingly involves both a more complex division of labour within families and, simultaneously, a delegation of some decisions to non-farm units in the private sector.

## "CLASSIC" AND "NON-CLASSIC" FARM ENTERPRISE ORGANIZATION

The Canadian farming system is diversely structured; we should properly speak in the plural of agricultural structures rather than the structure of agriculture. We have synthesized the multiple dimensions of agricultural structure in order to identify the major types of farm enterprise organization. As a step towards introducing this synthesis, it is necessary to summarize our previous findings concerning economic concentration and social mobility in the farm sector (Bollman, 1983a: 1983b; Clemson and Bollman, 1985; Ehrensaft, 1983; Ehrensaft et al, 1984; Ehrensaft and Bollman, 1985).

## Economic concentration and social mobility in agriculture

The major findings in our research relevant to managing Canadian farm enterprises are the following:

1) The relatively minor decline in the number of farm operators (–5.9% between 1976 and 1981) was created by major entry and exit rates in the farm sector; 29.7% of the 373 782 farm operators in 1976 quit agriculture before 1981 while 25.3% of the 317 758 farm operators in 1981 had entered the sector since 1976.

2) There is a gradual but persistent rate of economic concentration among the surviving and entering farms. When farms are ranked in terms of gross farm sales, we find that the top quarter of the farm enterprises generated 74% of sales in 1981 as compared to 72% in 1971. The top 5% produced 38% of sales in 1981 and the top 1% generated 19%.

3) The entry and exit rates for commercial farm, defined as units with sales above the median ($21 804 in 1981, 92% of sales), are significantly lower than those for the sector as a whole; e.g., the entry rate was 14.6% for 1976–81. In addition, the mobility rates from small farms to commercial farms, and from mid-sized commercial farms to larger scales of production, are relatively restrained.

4) Economic concentration is accompanied by an internal reorganization of farm enterprises. To cite two instances: as farm size increases, family labor no longer suffices to meet all or most of the needs of the farm enterprise and non-family labor is hired. Farms employing 2 or more person-years of paid labor generated 17% of gross farm sales in 1981. As the scale of enterprises and thus potentially taxable income increases, there is a trend towards incorporation in order to lower tax bills. In 1981, 15.5% of farm sales came from family corporations and another 3.5% from non-family corporations. While the latter type of farm corporation, usually involving control of agricultural production by non-farm enterprises, plays a minor role in Canadian agriculture as a whole, it can play an important role in sub-sectors such as poultry or horticulture.

5) In terms of the financially stressfull post-1981 years, both the 1984 Farm Credit Corporation survey and the National Farm Survey indicate the following relation: the larger size class of farm enterprises, the lower the proportion of farms in severe financial stress. It appears to be mythological that very big farms got big by highly leveraged borrowing or that they have high ratios of purchased intermediate inputs relative to gross sales and are thus more vulnerable to price downturns than mid-sized family farms.

6) It is often said that the structural transformation process in Canada is 10 years behind that of the U.S. when we compared Canadian gross sales concentration data with that in the neighbouring states of the northern United States which have similar climates, soils, and commodity mixes, the indices were virtually identical.

## The multiple dimensions of structure: A synthesis

Synthesizing the multiple dimensions of agricultural structure which are accessible in the census data[1] yields ten forms of farm enterprise organization which are divided into two groups: 1) "Classic" forms which have constituted the core of the agricultural systems of Canada and the northern United States since the mid-nineteenth century and 2) "Non-classic" forms which have become important during the past two decades and are likely to assume an increasing role during the next two decades. The classic forms include: "full-time family farms"; "part-time family farms"; "part-time farmers on part-time farms"; "full-time farmers on part-time farms"; "retired farmers"; and Hutterite colonies. Non-classic forms include "semi-managerial farms"; "independent managerial farms"; "integrated managerial farms"; and "agricultural holdings by non-family corporations".

The definiton and underlying concepts for each of the ten forms of farm enterprise organization will now be examined:

## CLASSIC FORMS

*Full-time family farms*: gross farm sales[2] are at or above the median ($21 805 in 1981); under 2 person-years of paid labour are employed; the farm operator works under 96 days off the farm; legal organization is either individual proprietorship, partnership, or a family

corporation. These criteria are chosen with the objective of selecting enterprises where the major occupational commitment is to farming, the farm family provides a major share of the labour input, and farm sales are at a level which have the potential to provide an adequate living.

The median gross farm sales level is intended as a limiting case: an older farmer who was debt-free and whose children had grown up would probably obtain an adequate current family income at this sales level if the imputed values of housing, the real use of tax-deductible car and truck expenses for personal purposes, and subsistence food production were added to reported net farm income. When under 2 person-years of paid labor are employed, partnerships clarify financial arrangements between cooperating family members or cooperating farm families: family corporations lower tax obligations for enterprises operating at higher sales levels: both are alternatives to individual proprietorship for family farms.

*Part-time family farms:* equivalent to the full-time family form except operator reports 96 or more days off-farm work.

*Part-time farmers on part-time farms:* farm operators report 96 or more days of off-farm work and sales in the 1-49th percentiles (less than $21 805). A "part-time farm" means an agricultural enterprise whose low level of farm sales could not, as the sole source of income, provide an adequate family income.

*Full-time farmers on part-time farms:* farm sales are less than $21 805 but operators are under 65 years of age and report less than 96 days of off-farm work. A retired person on a small farm would report less than 96 days of off-farm work and thus be misclassified as a full-time farmer. Consequently, operators at or above the standard retirement age of 65 years were excluded from the full-time farmer on part-time farms category.

*Retirement farms:* census-farms reporting less than $21 805 gross sales which are operated by persons 65 years or over.

*Hutterite colonies:* the colonies have been a component of rural social structure in the prairies since the early part of this century. What is new is their expansion in numbers of colonies and aggregate sales at the same time that farm consolidation has proceeded in the agricultural sector as a whole. The colonies are properly viewed as a classic form of enterprise organization that has proved well-suited to the post-1945 phase in the structural transformation of agriculture.

## NON-CLASSIC FORMS

*Semi-managerial farms:* census-farms with individual, partnership, or family corporation types of legal organization that report 2-5 person-years of salaried labor. With the increased proportion of labor provided by hired workers, the farm operator is in transition towards spending more of his time supervising other people's work rather than working directly in the field or barn. Non-family incorporated farms with 2-5 person-years of paid labor are excluded from ed workers, the farm operator is in transition towards spending more of his time supervising other people's work rather than working directly in the field or barn. Non-family incorporated farms with 2-5 person-years of paid labor are excluded from the semi-managerial category in order to distinguish between larger farm enterprises which result from the expansion of family farms and those which may involve farm ownership by firms with origins and operating bases outside the agricultural sector.[3]

*Independent Managerial farms:* census-farms that report 5 or more years of paid labor and are organized as individual proprietorships, partnerships, or family corporations. At this level of labor utilization, farmers complete the transition from operator-laborers to operator-supervisors. Non-family corporations are excluded from this category for the same reason as they are excluded from semi-managerial farms.

*Integrated managerial farms:* census-farms which are legally organized as non-family corporations and which have gross sales which place them in the 75th percentile or above ($56 000+ in 1981). The top 25 percent of farms accounted for 74 percent of gross farm sales in 1981. We are interested in the penetration of this core of the commercial agricultural system by non-family corporations. We did not apply the semi-managerial or managerial paid labor cut-off points because it is very important in structural terms if non-family corporations can control commercial enterprises which operate with labor inputs typical of the classic full-time family farm. Given modern poultry production technology, for example, a processing company

could employ 2 persons and produce a very large quantity of meat or eggs.

*Agricultural holdings by non-family corporations:* census farms owned by non-family corporations and which have gross farm sales which rank them in percentiles 1-74 (less than $56 000 in 1981). At these lower sales levels, apart from the odd start-up enterprise, the principal objectives of non-family corporate holdings of census-farms are investment gains on land or tax benefits rather than agricultural production per se.

## Farm enterprise organization: National patterns

The structure of the agricultural sector presents a double reality: the full-time family farm still generates the lion's share of agricultural sales but non-classic enterprise forms are steadily increasing their share of total production. In 1981, Canada's 140 745 *full-time family farms* 44.3 percent of census-farms) accounted for 66.2 percent of gross agricultural sales, with average sales of $79 258. This compares with 43.1 percent of the census-farms and 67.7 percent of total sales in 1971. (Tables 1 and 2) Part-time family farms, enterprises in the 50+ sales percentiles and under 2 person-years hired labor where the operator "moonlighted" by working 96 or more days off the farm, represented another 6.7 percent of the census-farms and 7.7 percent of sales. In 1971, they represented 5.2 percent of the census-farms and 6.4 percent of sales. Together, the two classic forms of commercial family farms generated 73. percent of gross agricultural sales in 1981 compared to 74.1 percent ten years earlier.

Non-classical forms of enterprise organization, however, generate an important segment of total national production. *Semi-managerial farms* represent 2 percent of census-farms, but, with their average sales level of $222 626 they accounted for 8.5 percent of national sales, compared to 1.2 percent of the farms and 7.2 percent of sales in 1971. The 1 865 *independent managerial farms* (0.6% of census-farms), with average sales of $625 581, produced 6.9 percent of total sales as opposed to O.3 percent of the farms and 5.8 percent of sales ten years earlier. *Integrated managerial farms* (880, 0.3% of census-farms) reporting average sales of $643 640, and generated another 3.4 percent of sales, up from 0.1 percent of the farms and 2.3 percent of sales in 1971. Together, the three non-classic forms represent 18.8 percent of gross agricultural sales in Canada compared to 15.3 percent a decade earlier. This share is likely to increase over time.

The relative balance between classical and non-classical farm enterprises varies by commodity sector and by region. Space limitations prevent us from presenting these patterns. Suffice it to say, however, that the tendencies measured at the national level for all farm types are at work in all sectors, including such traditional strongholds of the family farm as western grain and eastern dairying.

## FARM FAMILIES AS THE MANAGEMENT UNIT IN AGRICULTURE

At the level of commercial farming, 86 percent of the enterprises involve "economic families"[4] with a male farm operator and female spouse present, and the legal organization of the enterprise as an individual proprietorship, partnership, or family corporation. Commercial farming is still very much a family affair, even at the top end. The Census of Agriculture requests that only one person on a farm unit identify himself or herself as the farm operator. This forced choice has an advantage for various analytic tasks relevant to agricultural policy, e.g., measuring entry-exit patterns. For other purposes, however, such as measuring who really participates in management decisions, the forced choice does not indicate the desired information. In a time when male-female relations have been undergoing important changes in society as a whole, it is likely that the formal and informal roles of wives in farm decisions and ownership arrangements have increased. In fact, it is our hypothesis that this role was already quite important before the changes in male-female relations in recent decades. Entry into the commercial levels of agricultural production is difficult without inheritance of the family farm or aid such as co-signing of loans. Moreover, the retirement of parents and taking over the farm by offspring is a gradual process and often not completed until a son or daughter is 35-45 years of age. The management decision process is much more of a collective family process than indicated by the Census of Agriculture data.

Fortunately, the "Ag-Pop" data base, which links the information on occupation, income, and labor time for each family member that is available on the general Census of Population to the Census of Agriculture data, gives us some indices of the farm family as a collective economic unit. We say "some indices" because it is often not one economic family on one census-farm which is the relevant decision-making unit but several census-farms operated by related individuals. For example, a father and two sons may operate their grain and pastures together while having three separate livestock operations. What is "the farm" in this instance? But let us be thankful for what we have in the Canadian Ag-Pop data, which is superior to the information available in most other countries and takes us some distance towards understanding the relevant unit in farm management decisions.

In terms of income flows, the contribution of the spouses and other family members with male farm operators ranges from 26 to 34 percent for the different size classes of commercial farms.[5] It is likely that farm enterprise decisions take account of total family income rather than just the operator's combined farm and non-farm earnings. It is also likely that contributions to total family income are accompanied by some voice in farm decisions. However, if we take the income ratios as a rough index of how much power each family has, it would also be evident who has the loudest voice.

Labor time is the other available index of total family participation in the farm enterprise. Let us focus on what is known about the spouses of the male operators of commercial farm enterprises. Among these women, 32 percent indicated a farm occupation (paid or unpaid), 31 percent indicated a non-farm occupation, and 37 percent did not indicated an occupation. For the latter group, there is no information on their possible direct labour contribution to the farm enterprise (indirect labour such as household chores and childcare which may be an important contribution to the efficient functioning of the family farm is excluded in the question on hours worked).

Wives reporting an agricultural occupation indicated an average of 28 hours of work, both agricultural and non-agricultural, while their husbands indicated an average of 66 hours (the ratio of wives' to husbands' hours = 0.43). These women provided an average of 18 percent of total family income. For wives reporting a non-agricultural income, 18 hours of work per week were reported as opposed to 60 hours for husbands (ratio = 0.31) and they provided 26 percent of total family income. Average combined incomes of the farm couple were also $2 000 higher where the wife declared a non-farm income. We expect that future research will indicate the important contribution of other family members, mainly unmarried children over 15 years of age still residing on the parental farm, towards the total family labour budget.

Contributions of time and income by wives and other family members are likely associated with some give and take on major farm decisions. Among urban households, the increased participation of women in the labour force means that a majority of couples are now making decisions based upon expected joint earnings. On commercial farms, where the enterprise and household are still integrated, the spouse's role is important not only in terms of the direct labour force contribution as officially defined but also the indirect housework and childcare contributions. Because there is more "jointness" in keeping the farm running than is the case in urban families, we expect that there is more jointness in decision-making on important manners. The farm operator might decide on the ratio of wheat to rapeseed on his own, but the decision to buy more land or a new combine is likely to involve a lot of discussion around the kitchen table.

## THE CHANGING TASKS OF FARM MANAGEMENT

Structural changes in agriculture entail new ways of combining labour, land, financing, and knowledge in order to produce and market agricultural commodities. Management decisions involve new kinds of relations with large bureaucracies, both public and private. Economic concentration in agriculture has transformed commercial farmers into a rural minority even in most of the core producing regions, and this involves managing relations with the non-agricultural rural majority.

The new ways of combining labour, land, financing, and knowledge will be illustrated by the example of the Bill Richards farm in Circlesville, Ohio. The Richards enterprise,

which was featured in a Wall Street Journal article of November 13, 1984, is a prime instance of what we have termed the independent managerial farm. Richards and his two sons, Bruce and Steven, run a 8 500 acre corn and soybean operation which had $2.8 million gross sales in 1984 and employed 12 salaried workers. We expect that farms operating at this scale of production would be viable for both the Ontario and Prairie grain sectors. Their farm is an excellent indicator of managing enterprises which are on the leading edge of structural change in the agricultural sector.

## Managing the family

The number one task in managing commercial farms, in view of what we have just discussed, is managing the family. Emotional management within families is a complex affair under all circumstances, and more than doubly so when the survival and prosperity of an enterprise depends on family members getting along well and making wise decisions. Farm families must face up to a tough and volatile external environment at the same time that changing social norms concerning husband–wife and father–son[6] relations will test established ways of doing things.

The importance of the family is probably be enhanced at the top levels of production, most of which is controlled by family corporations. For the official farm operator, there is a cash flow advantage in bringing his children into the operation: hired managers expect higher salaries than sons who can wait to take over the enterprise and eventually make capital gains. There is also a motive for top farmers to continue to have more children than urban dwellers in the same economic class: this increases the likelihood of having at least one son who is competent and willing to take over the farm.

We also hypothesize that the shift in management tasks for top farmers from working in the fields and barn towards supervising hired labour and coordinating production, financing, and marketing decisions is rife with the potential for increased generational conflict. There can already be tension on mid–sized farms over when fathers retire and sons take over. The increasingly mental work for operators of large farms may well push back the retirement date and thus raise tensions.

In the case of the Richards farm, the father, who was 53 years old in 1984, functions as chief strategist and plotter. One 28 year old son, Bruce, is the marketing specialist: he follows the futures market on a daily basis and constantly monitors relative prices for alternate means of transporting grain. His other son, Steven, aged 30, is in charge of all field operations. Family relations thus provide the basis for specialization of management tasks. On the other hand, it is likely that the father, whose main task is now coordination and planning, will be capable of running the farm for at least another 15 years. The Richards sons may thus find themselves in subordinate and positions even as they enter their prime middle–aged years.

## Managing paid labour

Paid workers supplied 27.6 percent of the total labour input for agriculture in 1981. Farmers which hired more than 2 person–years of paid labour annual generated 18 percent of farm sales, up from 14.4 percent in 1971. The farms which employ under 2 person–years of labour are likely to take on seasonal as opposed to full–time workers. In addition, an important proportion of this paid labour is likely to consist of family members who are being paid wages in order to split farm income and thus the total tax burden. When 2 or more persons are employed, they are more likely to be full–time workers in most Canadian agricultural sectors and, while family members still receive salaries, most of the workers are unrelated persons. Although the 2+ person–year "owner–employer" farms constitute only 2.6 percent of the census–farms, they employ 50.6 percent of the paid labour.

The owner–employer farms are likely to encounter a rigid labour cost structure. Full–time workers involve an important investment of time and energy by the farmer in order to choose and train efficient workers. It is thus difficult to lay off these workers during price downturns. As a small business entrepreneur, the farmer is not in the same position to offer fringe benefits such as pension and health plans as would be larger employees. This can be countered by means such as profit–sharing, the right for the employee to keep his own livestock on the farm or eventual acquisition of capital shares if the worker is highly valued. The quality of housing offered to the employee is also very important, since an unpleasant living situation and thus an unhappy spouse may lead to the employee leaving for greener pastures.

The number of workers on most owner–employer will still be small enough for the relation to be highly personal and thus demand careful attention on the part of the farmer.

Another response to the task of controlling a hired labour force is an intensified search for technical means to reduce the labour input, the Richards' goal is to reduce an already efficient labour force by one–third, with an ultimate goal of employing one man per every thousand acres.

On the largest farms and commercial farms aquired by non–farm investors, hired managers will play an important role. The 1981 Census estimated that the number of farm managers had grown to 30 010 from 19 035 in 1971. However, many of these persons are likely to be self–employed from operators who misclassified themselves on the questionnaire. A more accurate measure is the estimate of 4 710 salaried farmers or farm managers. Even here, an important fraction of these persons likely consists of farmers who have incorporated their enterprises and are paying themselves a salary rather than taking profits directly. This being said, we are still left with several thousand bona fide hired farm managers. The number is likely to grow.

To the argument that farm managers could not be induced to spend the kind of hours that owner–operators put into their farms, we can only reply: why not? Young executives anxious to climb up the corporate ladder put in long work weeks that rival the labours of the hardest working farmer. With the righ kind of incentives built in, hired farm managers can be expected to do the same and are in fact doing so across North America. The possibility of employment as a hired manager may also open up agriculture to people from non–farm backgrounds with the desire and aptitude for a commercial farming career.

## Land and financing

Soil scientists are voicing increasing concern as evidence comes in on the degree of soil degradation that has arisen with contemporary cropping practices. As awareness of this degradation spreads, farmers will pay more attention to conservation practices both to maintain land productivity during the course of their career and to guarantee the capital value of the land when it is sold upon retirement. Given the trend towards mixed ownership and rental of land as farm size increases, we can also expect landowners who are renting out their holdings to become more demanding in attaching clauses on land use and conservation practices during the course of the lease. Some of the decisions that have hitherto been the domain of the farm operator will thus be transferred out of his hands.

A similar transfer can be expected for a wider range of management practices because of conditions attached by financial institutions to farm loans. The current years of financial stress are going to leave a lasting nervousness by lenders with respect to farm loans. Banks are likely to specify a widening range of management choices as a criterion for lending money. Whether bank managers are likely to be better than individual farmers in making choices is open to question: we rather think the desire to control risks will lead to rigidities and slower adoption of innovations among the dynamic farmers who are labeled "early adopters". On the other hand, bank pressures will likely speed up adoption rates among the middle group of farmers who eventually incorporate the practices pioneered by the early adopters.

The Richardson's reaction to land costs and other financial pressures illustrates one kind of top farmer strategy. They are pulling out of land ownership even though their solid financial position would enable them to pick up much land at bargain prices. Their calculation is that capital is best invested in new generations of machinery and other innovations which can make operations profitable even as grain prices tumble. Not all top farmers read the market in this way.

In our studies of the structure of Prairie grain production, we found that the top 1 percent of producers (2000+ acres in grain) moved towards either renting all their land or owning all their land. Up until this top percentile, one observes that the larger the size class of farms, the higher the proportion of partly owned, partly rented farms; within each size class, the average acreage of the partly owned farms exceeds the average acreage of wholly owned farms, which in turn have larger average acreages than wholly rented farms. For the top 1 percent, wholly owned farms have the highest average acreage, followed by wholly rented farms, with the partly owned farms having the lowest average acreage. In both the case of reverting to total ownership or moving to totally rented land, we believe that both represent strategies to increase the operators'

control of financial risk and to keep decisions within the farm enterprise rather than sharing them with non-farm interests: different operators read the market and thus strategy in different ways.

The Richards also increase their autonomy by moving beyond the local rural banking network and dealing with two large urban banks. In the Canadian context, this strategy could be enacted by dealing directly with head offices rather than local branch managers. Being big is, of course the main factor in carving out more autonomy, since banks will be inclined to let big successful firms go their own way. But the ability to deal with larger, distant urban banks, and several of them at one time, is a good way of both driving a better bargain and keeping bankers at arms' length.

In terms of the way the Richards manage the land, their practices are consistent with what we observed in Prairie grain farming. The Richards were pioneers in minimum tillage techniques and then zero tillage. In the moister soil zones of the Prairies, we observed that the larger the size class of grain farms, the lower the average proportion of land in summer fallow. With respect to soil conservation, it appears that "big is beautiful" rather than small being beautiful. The bigger, innovative farmers tend to think that it makes both short-term and long-term economic sense to sustain soil quality. They also have a more secure base for acquiring new kinds of equipment and experimenting with new techniques.

## Managing relations with big bureaucracies

Farmers are already used to managing relations with the biggest bureaucracy of them all, government, because of the increasing intervention in the farm economy since World War II. It is probable that current discussions of deregulation in the farm sector will merely slow the expansion of government for a while rather than achieve any notable reductions. In particular, paying attention to the tax implications of management choices will occupy an increasing portion of the farmer's time and energy, or the time and energy of specialized accounts whom he hires.

The major expansion in bureaucratic intervention is likely to come from the private sector. In our view, large public and private bureaucracies do not function in markedly different ways. The kind of arrangements typified by vertical contracting in hogs and poultry are likely to multiply. Once again, the farm operator will see some of his decisions transfered to off-farm interests. The market will be increasingly mediated or replaced by a thicket of bureaucratic networks. Farmers will probably rely more on management consultants who can help producers navigate this thicket and also deal with complex monetary markets when making investment decisions.

## Managing knowledge

As new technology multiply the alternatives for farm operators and inexpensive access to data bases multiplies the mass of available information, new means of assimilating and acting upon this knowledge must be developed. Herbert Simon points out that human beings cannot think of more than 4 to 6 things at a time and must develop rules of thumb in order to simplify their environment and reach decisions. Traditional means such as extension agents or visits from agri-business representatives are not likely to fit the bill. The answers are likely to come from two directions.

As farm enterprises expand in absolute size, family members and hired managers can become specialists in different areas of farming, as suggested by current practices on the largest family farm corporations. The other route will likely be through private farm technology consulting firms. We expect that these firms will quickly evolve to provide real services as opposed to some of the expense account padding that often goes on in the upper reaches of the corporate economy. In the rather recent past, a prairie farmer, for example, faced a rather standard menu of options in terms of technological choices. Now the options are multiplying and will do so over more in the future. A bad technological choice can put a farm at risk. The consulting firms which are sloppy and hand out poor advice will be likely weeded out from the market in short order.

The complexity and constant change in the technologies and economic environment confronting farmers would naturally lead us to think that education will be very important for future farm operators. When we examined average years of education for successive size

classes of commercial farms (50+ sales percentiles), there was a mild tendency of education to increase with farm size. This was present for both the age cohort which was the core of commercial agriculture, the group which was 35–54 years old as of the 1981 Census, and the under 35 group, while the younger cohort had more education than the older – 12 years as opposed to 11 years – there was nothing to shake a stick at. The new generation of farmers has about the same level of education as the general Canadian population in the same age bracket. At the very top end, $400 000+ in gross sales, average education goes up by one year again. We expect that this reflects a younger person inheriting a large farm: wealthier farmers may send their offspring to college because it's the right thing to do but it remains to be proven whether this experience plays a direct causal role in better farm management.

Let's see how these factors work out in the case of the Richards. Both the father and one son have agricultural economics degrees, while the other son went partly through university before returning to farm management. They subscribe to the Financial Times of London and their "bathroom reading" is the periodical International Economic Indicators. Between the three, they attend roughly 20 agricultural seminars annually and contact experts at Purdue and Ohio State.

The most important means of keeping abreast of new technologies and economic events, however, is not the university but other farmers. Once a month, the Richards get together with other large farmers in order to exchange their knowledge and experiences. These meetings, plus the decision to concentrate production on two crops in order to channel energies devoted to discovering new techniques and market developments, constitute the heart of the innovation process. We suspect that the Richards' university education is more an index of their inclination to engage in the discovery process rather than an index of a socialization process which altered their way of seeing the world and arriving at decisions.

## Managing relations with rural non–farmers

As farm consolidation proceeded after World War II, farmers became a rural social minority. As of 1981, rural Canada was evenly divided between the farm and non–farm populations. By 1981, the rural farm population only accounted for 4.4% of Canada's total population as opposed to 19.8% for the non–farm rural population. Even in the most agricultural of Canada's provinces, Saskatchewan, the ratio of the farm to non–farm population was 0.8.

Farmers in the core agricultural production regions of Canada may find themselves in conflict with the non–farm population over plans for regional development or simply their farming operations. Non–farmer complaints about the odors of hog farming would be the classic example. As the absolute size of farm operations and the use of hired labour has increased, commercial farmers have been transformed from the backbone of "the people" in rural regions to part of the local elite. Achieving their objectives as farmers involves building bridges and coalitions with other elite groups in rural communities.

The top farmers have become an elite within an elite, and their transformation of the structure of agriculture has also reshaped the rural economy in general. The Richards, for example, are part of an 18 member purchasing group which searches as far as Iowa and Alabama for better prices on supplies and equipment. The group achieves an average economy of 25 percent on input purchases. Their bypassing of local merchants has contributed to a decline in the number of local farm–related commercial enterprises. Installation of grain storage capacity on the larger farms has also contributed to the decline of local grain elevators. Direct dealings with large regional banks has already been cited. As a consequence, there is a general resentment and apprehension on the part of mid–sized farmers towards families like the Richards. When the Richards invite friends for dinner, these friends are lawyers, contractors, or the managers of local manufacturing plants.

## CONCLUSION

The "green revolution" of the post–World War II decades changed the nature of the enterprises which farmers must manage. The trend towards fewer but larger farms, including a gradual but persistent increase in the rate of economic concentration among surviving units, was accompanied by an internal reorganization of farm enterprises. The "non–classic" enterprises

are increasing their share of total agricultural production. These farms face challenges in managing hired labour, evaluating the impact of the tax system on profitability, and relating financial market developments to production and investment decisions on a scale quite beyond the horizons of the traditional family farm.

At the same time, most of the large, non–classic enterprises are run and controlled by families which expanded their scale of operations. The Richards farm, for example, began as a modest–sized mixed farming operation. Family relations, particularly specialization of management tasks, are integral to the operations of these large farms. In the non–classic as well as the classic farms, the farm family rather than the official farm operator is the unit or actor in making major decisions.

As the mid–sized farms grow in absolute size, they will be facing more of the management challenges experienced by the non–classic farms. The management tasks of farming will increasingly focus on managing knowledge and on managing people. With respect to the former problem, the farmer's problem will not be getting a hold of information but sifting through too much information. As the Richards' example indicates, the sifting process will depend both on creative relations within the family and with other farmers. when the hiring of full–time labour is considered, plus relations with professionals such as accountants and consulting firms, we see that farm management is becoming more like management in non–farm sectors: managers must think at least as much about managing people as they do about managing physical operations. Today's farm manager must deal with the vagaries of weather, biology, markets, and, above all, other people.

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1 Level of production, part–time versus full–time farm occupations, employment of paid labour, part–time versus full–time farm occupations, and legal organization.

2 Reported sales or imputed sales if a farm with large crop or livestock inventories indicates low gross sales.

3 The correlation is not perfect: e.g., a family–held manufacturing company might buy a farm which would be classified as a family corporation while two farm families might merge their operations into a "non–family" corporation.

4 Defined as a group of persons related by blood, marriage, or adoption who share a common dwelling.

5 percentile: 50–74; $21 805–59 999; 75–94; $60 000–159 999; 95–98; $160 000–399 999; $400 000 +

6 We say "father–son" relations because evidence indicates that few daughters are taking over commercial farms.

## TABLE 1 TYPOLOGY OF CENSUS-FARMS[1], CANADA, 1971 AND 1981

| Typology | 1971 Number of farms | 1971 % of total | 1981 Number of farms | 1981 % of total | % change 1971–1981 |
|---|---|---|---|---|---|
| **Classic forms** | 359 920 | 98.2 | 308 760 | 97.1 | -14.2 |
| Full time family farmers[2] | 158 910 | 43.4 | 132 040 | 41.5 | -16.9 |
| Part-time family farmers[3] | 18 990 | 5.2 | 17 985 | 5.7 | -5.2 |
| Part-time farmers on part-time farms[4] | 63 285 | 17.3 | 68 215 | 21.5 | +7.8 |
| Full-time farmers on part-time farms[5] | 91 215 | 24.9 | 68 970 | 21.7 | -24.4 |
| Retirement farms[6] | 27 365 | 7.5 | 21 080 | 6.6 | -23.0 |
| Hutterites and "other"[7] | 155 | .04 | 470 | 0.1 | +203.2 |
| **Non-classic forms** | 6 495 | 1.8 | 9 085 | 2.9 | +39.9 |
| Semi-managerial farms[8] | 4 370 | 1.2 | 6 210 | 2.0 | +42.1 |
| Independent managerialfarms[9] | 1 150 | 0.3 | 1 810 | 0.6 | +57.4 |
| Integrated managerial[10] | 540 | 0.2 | 665 | 0.2 | +23.1 |
| Holdings by non-family corporation[11] | 370 | 0.1 | 400 | 0.1 | +8.1 |
| **Total** | 366 410 | 100.0 | 317 850 | 100.0 | -13.3 |

1 Institutional farms and community pastures are excluded.
2 "Full-time family farms" are proprietorships, partnerships or family corporations with gross sales above the median (1971: $5 560; 1981: $21 805), with under 2 person-years of paid labour and the operator works 0–96 days off-farm.
3 "Part-time family farmers" are as full-time farms except the operator works 97 or more days off the farm.
4 "Part-time farmers or part-time farms" are farms with sales less than the median and the operator works 97 or more days off the farm and is under 65 years of age.
5 "Full-time farmers or part-time farms" are farms with sales less than the median and the operator works 0–96 days off the farm and is under 65 years of age.
6 "Retirement farms" are farms with sales less than the median and the operator is 65 years of age or older.
7 "Hutterites and other" includes Hutterites, trust, estates, co-operative farms, etc.
8 "Semi-managerial farms" are proprietorships, partnerships or family corporations with gross sales above the median and 2–5 person-years of paid labour.
9 "Independent managerial farms" are as semi-managerial farms except with over 5 person-years of paid labour.
10 "Integrated managerial" are non-family corporations with gross sales above the 75th percentile (1971: $12 060; 1981: $56 000).
11 "Agricultural holdings by non-family corporations" are census-farms that are non-family corporations with gross sales below the 75th percentile.

*Source*: Canada. Statistics Canada. Agriculture-Population Linkage, 1971 and 1981.

## TABLE 2 MARKET SHARES, CLASSIC AND NON-CLASSIC FARM ENTERPRISES

| Typology | 1971 Number of farms | 1971 % of total | 1981 Number of farms | 1981 % of total |
|---|---|---|---|---|
| Classic | | | | |
| Full-time family farms | 43.1 | 67.7 | 44.3 | 66.2 |
| Part-time family farms | 5.2 | 6.4 | 6.7 | 7.7 |
| Total share | | 74.1 | | 73.9 |
| Non-classic | | | | |
| Semi-managerial | 1.2 | 7.2 | 2.0 | 8.5 |
| Independent managerial | 0.3 | 5.8 | 0.6 | 6.9 |
| Integrated managerial | 0.1 | 2.3 | 0.3 | 3.4 |
| Total share | | 15.3 | | 18.8 |

# Farming with low levels of purchased inputs

*D. Pimentel*

Because of high production costs and resource degradation, Canadian and U.S. agriculture are in serious trouble. Record numbers of farmers are going bankrupt. Where normally about 3% of the farmers go out of business each year, the percentage is projected to reach about 6 times this level in about a year. Current farm management practices require large amounts of fertilizers, pesticides, and other inputs that often result in production costs greater than $500 per hectare. These high production costs and relatively low returns to farmers are, in part, the reason for large numbers of farm bankruptcies.

Contributing to the high level of inputs now needed in agriculture is the serious degradation and mismanagement of resources on farms. In some regions half the topsoil already has been lost in just a little over 100 years of farming. The average rate of soil loss in nearly 20 t/ha/yr. With soil formation rates at only 1 t/ha/yr, soil is being lost almost 20 times faster than it can be replaced. Several million hectares of valuable cropland already have had to be abandoned because of erosion.

Associated with soil erosion is rapid water runoff, which reduces moisture availability to the crop. Lack of moisture is the single most important factor limiting crop production. At the same time, water runoff removes soil organic matter and vital nutrients. Nutrient loss, associated with erosion, is a major cost to agriculture. For example, about 100 kg of nitrogen is lost along with 20 tonnes of eroded topsoil. Based on current soil erosion rates in the United States estimates are that at least $150 worth of nutrients are lost annually per hectare. Taken together, these factors all contribute to reduced productivity of the land.

If soil and water conservation and other sound environmental management practices were employed in agriculture, farm costs could be greatly reduced. For instance, crops can be grown with relatively low levels of energy inputs while maintaining current high yields, if we will: (1) maximize the use of biological resources while minimizing energy inputs; and (2) employ adaptative agroecosystem designs.

Practical ways to maximize the use of biological resources include: using legumes as "green manures"; using livestock manures; conserving moisture with mulches; and relying on natural parasites and predators for biological pest control. Further, when agroecosystems are designed, they should be more compatible with the existing natural ecosystem, then fewer costly inputs are needed to maintain the system. Other strategies include raising row crops on slopes where the soil erosion threat is minimal and developing crop varieties that have some degree of natural resistance to pests in a particular region, and substituting them for the varieties presently used.

Employing these and other sound ecological principles in agricultural production can reduce farm costs while maintaining current high yields. Such changes would help make agriculture more economically productive and have the added benefit of protecting the environment and public health.

Using an ecological approach for agricultural technology requires we focus on three primary factors: (1) conserving soil nutrients; (2) conserving water; and (3) making the agroecosystem a relatively unfavorable environment for pests. Based on this approach, it has been calculated that corn could be produced with low levels of inputs costing only about $360/ha compared with current high input corn production that costs about $540/ha. Corn yields for both systems would be the same and in reality might be higher in the low input, ecological system.

With some changes in farming practice, it will be possible to reduce levels of purchased inputs of fertilizers, pesticides, and other inputs, and still maintain high crop yields. These changes would make farming more economically sound, and would protect public health and the environment from worrisome pollutants. Ecologically based farming practices hold the promise of conserving vital natural resources — which will enable agriculture to maintain its high production of food and fiber, needed now and for future generations.

# Soil conservation, dryland farming and the farm machinery industry

*D. Shepherd*

There are two groups we rely on across the prairies, ourselves and the agricultural industry.

We rely on them to solve problems like dry weather, wind erosion and rocky soil.

And we learn from each other, from our ancestors.

That's how we learned about dry land farming. It took years, dust bowls and innovators. But we learned and we are still learning.

When we examine early dry land farming practices, it is much easier to understand the causes of soil degradation problems. The effects of deep plowing, powdery surface soil, elimination of surface cover, and continuous summerfallowing in dry areas is apparent. The result of these dry land farming practices became noticeable when wind erosion grew progressively worse during the 1920s and 1930s.

Today, farmers influence the character of the soil through cultivating, harvesting, deforestation, drainage, irrigation, manuring and general farming practices. The farmers have the power to increase or decrease the productive capacity of the soil and to control land erosion.

Governments are starting to recognize their responsibility for documenting the extent and cost of soil degradation, and for providing technical and in some cases financial assistance to assist farmers.

Many conservation-related experiments and demonstrations are going on. In 1981, the four western premiers decided to hold annual conferences on soil and water management.

In the final analysis, sound conservation involves using recognized erosion control measures to farm lands, according to their need.

There are nine steps to successful soil conservation as it applies to dry land farming. These include: basic soil knowledge, trash cover farming, fertilizers and manures, strip cropping, field shelterbelts, contour strip cropping, grassed waterways and mechanical aids, cover cropping and grasses and legumes in the farm rotation.

Increased production and greater farm worth are two major benefits resulting from using good conservation steps which are needed on every farm.

It is necessary to know the basic physical, chemical and biological properties of soil so that steps can be taken to apply erosion control practices to suit each individual situation. The most erosive soils can be protected by proper cropping and cultural practices.

Use of trash cover to protect soil against wind and water erosion should be the main feature in any erosion control program. Trash cover or stubble mulch farming means maintaining straw and stubble residues at the soil's surface during an entire summerfallow period. Lack of proper trash cover is perhaps the greatest single factor contributing to erosion damage on many farms.

Fertilizers and manures can be of vital importance in soil erosion control programs. Their use results in higher plant growth and production. More than 40 years of fertilizer testing in Saskatchewan has shown very favorable crop response on soils.

Trees grown in rows 100 to 200 metres apart will help control wind erosion by reducing wind speeds. Tree belts trap more snow on fields during winter to give more moisture for the following crop.

Farmer experience has shown improvement in water erosion control through the use of modified contour strip cropping plans.

The width of strips needed for contour farming varies with degree and lentgh of slope, texture of soil, and whether the soil is of lacustrine or glacial till origin.

Grassed waterways and mechanical aids for water erosion control are necessary. Gullies are signs of improper land use and show serious field erosion and immediate steps should be taken to grass them down.

The practices of late summer seeding of spring wheat, oats, barley or fall rye as cover crop provides a measure of soil erosion control on summerfallow fields.

Cover crops are usually seeded at half the rate of crop for grain. The best time to seed will vary from one part of the prairies to another but is usually during the first part of August.

Grasses and legumes, fitted into farm rotation, give soil protection while actively growing. They provide crops of hay or pasture, they add extra organic matter and improve soil productivity for the following crops.

Strip farming would probably have been the most common practice if it wasn't for the growing threats of grasshoppers, sawflies and other insects. These drawbacks convinced the farmers there must be a better way. Stubble mulch farming appeared to be a better solution to the farmers' problem.

The idea of keeping trash cover on the surface of the soil was one that had occurred to many farmers including their counterparts in the United States. It was the development of stubble mulch farming in Canada and the U.S. which made it possible for farmers everywhere to successfully grow wheat on dry lands. Many times grain grown on the prairies has been used to prevent hunger in China, Russia and India.

George Morris, founder of Morris Rod-Weeder Company Limited, a major farm implement manufacturer in Yorkton, Saskatchewan says minimum tillage is what saved the west. He maintains it's the only method of farming you can use on these open prairies. He says we caused a lot of our own problems when we put these deep plows into the ground. We'd still have the dust bowl going on today if we hadn't changed our ways.

Minimum tillage is the only way to kill these weeds and still keep the moisture in the ground. Trash cover forms an insulation and presents not only soil erosion but retains moisture. The moldboard plow cover from 90 to 100% of this trash while the rod-weeder covers 0 to 10%. Many other tillage tools, recently developed, leave as much as 75% of trash on top.

Understanding and respecting soil conditions is the key to successful minimum tillage practices.

The minimum tillage concept grew out of the gradual understanding that traditional farming techniques could not be applied on the plains.

The traditional farming methods had a negative impact on North America, both economically and environmentally. Lack of rain was not the only factor which caused the dust bowl. Some of the blame rests wth the farmers and the practices they used. As an example, the early 1960s were drier and windier on the prairies than the dirty 30s, but farmers did not have the dust bowls because they had been using the stubble mulch farming method for many years.

Today's farmer can take advantage of the many educational course offered through the University of Saskatchewan, community colleges and in some cases Saskatchewan Agriculture.

The University of Saskatchewan plans its agricultural extension events in co-operation with Saskatchewan Agriculture, farm organizations and agencies. An annual series of regional short courses on livestock, field crops, marketing, soils, machinery, agricultural economics and farm business planning are offered.

Community colleges also organize a wide range of adult educational programs for the farming community.

Saskatchewan Agriculture maintains agricultural representatives in 43 offices in the province. These offices supply a whole range of technical information and farm bulletins on almost anything that would be of interest to Saskatchewan farmers.

Today's farmer has learned that in economic terms, excessive tillage on summerfallow is a wasteful practice because of the increasing cost of fuel and high energy input required.

It is for this reason some are moving towards minimum tillage farming practices.

Minimum tillage is a system whereby the crop is seeded with minimum soil disturbance directly into the stubble. This is in direct contrast to conventional tillage where the topsoil is turned over by tilling, discing or plowing. Minimum tillage farming requires intensive and timely management with particular attention given to trash management, soil fertility, weed control and placing the seed at the right depth into moist soil. If a farmer wants to try zero tillage, it's a good idea to start on a small scale, choosing a field which has good drainage and where the history of weeds is known.

One practical minimum tillage tool is the rod-weeder which doesn't cut the roots but pulls them just as though they were picked individually by hand. As an example, weeds with roots 12 inches long, such as Canadian Thistle and Fire Weed can be pulled out, laid on the surface and will start turning black in a few hours.

The number of minimum till drills is growing and with it is the farmer's idea of what constitutes the perfect drill. It's a matter of whether you want hoe or disk type openers and which works best on your farm.

Some farmers believe a good minimum till drill should first be able to place the seed at a uniform depth regardless of trash conditions. Some say it should be able to band fertilizer. Choosing the right piece of equipment is as personal as selecting your own car.

Today, Morris manufactures a whole line of farm implements to meet the needs of today's farmers. All products developed by Morris were designed to work in dry land conditions. Keeping trash on top of the soil and moisture conservation are the goals of our research and development branch.

A great deal of money is spent on research and development with considerable risk to the manufacturer.

Morris has hooked up to the Saskatchewan Research Council's computer-aided/design and computer-aided manufacturing (CAD - CAM) program. The system allows manufacturers to hook into data banks at SRC in Saskatoon to test and produce new products. The manufacturer can design a new product on the screen, test its performance and save money because improvements are made before the product is built.

Equipment manufacturers are developing new seeders and other items built specifically for an increasingly conservation-conscious farming community.

But farmers are facing increased costs for equipment. His selection and use of farm machinery can greatly affect the financial success of his farm.

Machinery cost-management involves making decisions concerning size, type, custom hiring, purchase of new or used equipment, machine replacement and the level of investment in machinery that can be justified.

Air seeders have opened up a whole new minimum tillage seeding option. These machines are now being used on a variety of soils to seed into stubble land which has had a bare minimum of preseeding tillage. Air seeders are versatile units suited for mounting on regular cultivators for "once-ever" stubble seeding or for deep banding fertilizers.

In conventional cropping systems, stubble is worked several times before seeding. Under minimum tillage, a stubble field might be worked once or twice before seeding and then again at seeding time. Under the ultimate form of tillage (zero-tillage) it is left undisturbed right up until it's worked by the seeding implement, an air seeder for example.

Chemical fallowing has become a more acceptable and successful practice for leaving trash on top to prevent wind erosion. Rather than cultivating for weed control, chemical is used on stubble and summerfallow.

At one time it was believed that no practical substitute for tillage existed to obtain the benefits from a true summerfallow operation. Recent tests have shown much of the tillage once thought necessary can be replaced with timely herbicide applications without reducing the effect of summerfallow.

Research studies conducted over many years at Agriculture Canada's Melfort Research Station indicate a combined tillage-chemical method can save three to five tillage operations in the parkland region of Saskatchewan.

Results show two herbicide applications, one for annual grasses and broadleaved weeds in spring, and one for perennial broadleaved and winter annual in the fall, plus one or two summer tillage operations, gives the best erosion control combination without reducing the moisture or nutrient level of the soil or lowering future crop yields.

For chemical fallowing to be successful all weeds must be controlled with economical herbicide treatments.

The future of the prairie lands rests largely with man. He is the chief biological agent which influences the character of the soil.

Agriculture Canada's Swift Current Research Station surveys indicate some of the best Saskatchewan soils have lost more than 60% of their potentially mineralized nitrogen. Further research suggests at least five million acres of prairie land are now so short of organic matter, and thus nitrogen-supplying power, they should be fertilized after a year of summerfallow.

But soil scientists tell us the increasing loss of organic matter can be reversed.

Scientists have discovered when degraded soils are cropped to cereals, each year with proper fertilizer and tillage which conserves trash cover, organic nitrogen quantities begin to slowly recover.

The reduction or elimination of summerfallow and tillage is one method but it is not easy.

Heavier trash cover and less tillage would mean a dramatic change in weed control methods and seeding. The farmers who make the switch will probably find it takes years to perfect this cropping system. The challenge for farmers will be adapting equipment to do jobs which it wasn't designed for.

A farmer's income is also affected greatly by commodity prices. Forecasting prices requires an understanding of what influences and determines price. The demand for and supply of the commodity determines the price.

Rotating crops may take four or five years to plan. One of the common rotations in Saskatchewan is the half and half system of wheat and summerfallow. But no one particular crop rotation will be adaptable to everybody. Market conditions, soil moisture, pests and personal preference all influence cropping decisions.

Equipment manufacturers will also play a leading role in determining future farming methods. They have the responsibility of designing new equipment to meet the needs of the farming community.

Many farmers, because of low commodity prices and higher expenses, must get away from summerfallowing and practice continuous cropping.

But the swing to continuous cropping and minimum tillage has many farmers concerned. They face higher input costs due to escalating duel and fertilizer costs, "high-tech" equipment which can be expensive and probably less yields per acre each year.

Continuous cropping means irrigation, lengthened growing season for traditional crops, and diverse choice of crops and rotations. Although moisture conditions may be controlled by irrigation, practical rotations and market opportunities establish the range of choice.

Saskatchewan's semi-arid climate makes it a natural area for the development of irrigation. Over 3 000 farmers presently use some form of irrigation for crop production. About 70 400 hectares were intensively irrigated in 1983, with a future potential estimate of about 405 000 hectares. Once-a-year irrigation is used on about 42 000 hectares with a future potential estimate of 1 000 000 hectares.

Most farmer experience, and most crop research has been developed based on dry land conditions. Once moisture can be controlled by irrigation, other farming practices such as cultivating, seeding, cropping, fertilizing, weed and insect control must be changed which will result in higher operating costs at first.

Prairie weather, which on an average is excellent for grain production, is extremely variable.

Southern Saskatchewan was hit with one of the worst droughts in 1985 which resulted in almost total crop failure, a limited supply of fodder for livestock, water shortages, extensive wind erosion and if that's not enought herds of grasshoppers devastated remaining crops.

Yet the drought of '85 will not go into the history books like the Dirty 30s did.

Why? Because unlike the 30s, fewer farmers were forced out of business by this year's drought. The land has not blown away. With government assistance and a return of average moisture levels, crops can and will be planted, this spring.

The impact of drought can be minimized by changing the use of suitable lands, breeding drought-resistant crop varieties and practicing soil and moisture conservation.

Managing the snow pack to obtain maximum catch and infiltration is one way of practicing conservation. Managing lands to reduce evaporation less and increase infiltration during periods of excess moisture is another.

It's not easy surviving a drought, but it's heartbreaking if the soil is no longer there to plant when the rains finally come.

Today's dry land farming techniques have made this possible.

Tomorrows research including the development of equipment which can best serve new farming methods can make our land even more productive.

# The role of the input supplier in the sustainable management of soil and water

*B. Weese*

On behalf of the Western Fertilizer and Chemical Dealers Association, I would like to thank you for the opportunity to speak here today.

The Western Fertilizer and Chemical Dealers Association is an organization of prairie fertilizer and chemical dealers. We have a membership of over five hundred, which includes independent dealers such as myself, Co-op's, grain elevator companies, fertilizer and chemical manufacturers, as well as equipment suppliers to both the chemical and fertilizer industry.

When I was first asked to speak on soil and moisture conservation, I thought it would be an easy subject to address. I felt that all I would have to say is to move all the grain we can produce at a decent price and the rest would look after itself. Although that is certainly part of the picture, it is only a small part of the solution to soil and moisture conservation, as I have found out. In reading many books and government publications on this subject I have been shocked by the seriousness of the problem, not only on the Prairies, but all across Canada as well. The Canadian public as a whole, including government, the consumer, the agriculture supply sector, people involved in extension work, as well as the farmer himself, have to be made more aware of the problems of soil degradation that exist now, as well as the problems that will exist in the future.

The problems a farmer faces in controlling soil degradation are many; these problems vary greatly from area to area all across Canada. Each year, we lose many tonnes of top soil through wind and water erosion. Our organic matter levels are dropping steadily as we continue using the present tillage practices associated with summerfallowing. As well, salinity levels in our soils seem to ear, we lose many tonnes of top soil through wind and water erosion. Our organic matter levels are dropping steadily as we continue using the present tillage practices associated with summerfallowing. As well, salinity levels in our soils seem to be ever increasing. The net result of these problems is a lower productive level of our soils.

The issues that a farmer faces in order to control these problems are numerous. There is a definite lack of research into new and better management methods of control, as well as research into the economics of control. The farmer has to be able to understand and utilize the technology available at present, as well as the new ideas and technology that will be available in the future. In many cases, there will be a need for new equipment or modifications to existing equipment to adapt to programs such as zero or minimum tillage.

For the most part, I feel producers realize that summerfallow under intensive cultivation methods is not the ideal process and that they are doing damage to the long-term productive capacity of the soil. However, there still exists a general awareness problem that has to be overcome. Summerfallow, and the tillage practices associated with it, is a tradition in a very large area of the prairies. This practice has been carried on for generations. To change the tillage concept not only requires a change of methods, it also requires a complete change of attitude. Furthermore, the practices that would ensure a long-term return to the producer are being over-shadowed by the short-term needs he now faces. It is hard to spend money on a long-term investment such as soil conservation when cash is short, grain bins are full, and quotas are low.

I don't think governments, farm groups or individuals involved in this sector of agriculture have done a good job of informing people of the problems of soil degradation, nor have we done a good job of creating an interest in the media to inform. About a month and a half ago, I attended an agriculture policy conference in Saskatoon, sponsored by the Government of Saskatchewan. At the first session in the morning, Premier Grant Devine spoke, giving an outline of the program. The next session featured Mr. Esmond Jarvis and panel members in a discussion on grain marketing. Throughout the morning session, present were two television stations, several radio stations and many reporters covering the proceedings. After lunch, Mr. Lorne Hehn, President of United Grain Growers spoke on "Soil the Asset". Mr. Hehn and the panel members gave a good overview of soil

conservation and its importance. I think a sad reflection on the importance that the media pays to this subject is that no television or radio coverage was present and only a very few reporters were visible. I think it is up to government, farm groups, industry and anyone who is interested to make this subject one that has the urgency and importance of its message carried up front to the Canadian public.

The role of the input supplier in soil and moisture conservation is, and should be, a major part of the attack on this problem because it ties in directly with the day-to-day activities of the average dealer. It is the input supplier, not the extension person, that finds himself in the role of the major source of technical information and advise on fertility problems, interpretation of soil sample information, field record keeping, weed problems, chemical recommendations, input cost budgeting, soil and moisture conservation problems and a host of other related needs a farmer may have. A study done by Purdue University of U.S. corn producers showed that seventy-five percent of these farmers went first to their farm supply dealer for crop production information. I am sure that these numbers hold true in Canada as well. An important point to remember is that the dealer is, in general, well trained and broadly experienced in crop production information. However, in the area of soil and moisture conservation, the dealer is lacking much of the information and skills that will be necessary to help his customers fight soil degradation.

Farm supply dealerships tend to be the gathering and redistribution point of local information. The dealer also tends to work with, and use as example, the leading and most progressive farmers in his area. Many dealers have developed and are involved in high yield clubs. These clubs are formed by a group of local farmers to share the information, the ideas and the new methods of the participants. The goal of the club is to attain the maximum yield possible for the crops they are producing. The information gained from these factors allows the dealer to have a better knowledge of what is working well for his area. Using the innovative farmer is an important area for governments to look at also, when planning programs for farmers in general. The Farm Lab Project in Saskatchewan is a good example of this type of approach and one which deserves more support and exposure. We have available to us a large test plot being run by our leading edge farmers. In many cases, they are ahead of research in innovation and practicality. We have to tap this resource and draw from them in the same way the input supplier does, because the methods they are using today seem to become the accepted practices tomorrow.

It is in the dealers best interest to promote good soil and moisture conservation practices, not only because of the sales of supplies and services these practices will facilitate, but also because the long-term health and stability of his customers depends so much on stopping soil degradation. It is certainly fair to say that the economic success and stability of the farmer ensures the economic success and stability of the input supplier.

Over the past decade, input suppliers have grown rapidly in both facilities and equipment as well as expertise. The dealer can, and is quick to adapt to, new technology and demands. I see no reason why he should not be able to adapt to any needed conservation technology that may arise in the future. Given a change at a fair return, the dealer will invest in equipment, facilities and education to assist the farmer in any area he can to help stop soil degradation.

Farm supply dealerships across Canada are, I'm sure, participating either directly or indirectly in projects that promote good soil and moisture conservation. I would like to use my own dealership and the area I service as an example of what is happening in the field at the present time.

One of the new methods we used last year was to install granular chemical applicators on our deep-banding fertilizer rental equipment. In the past, the banding of fertilizer and the application of granular chemical would require two operations over the same field. Now, as the farmer deep bands his fertilizer, he can also apply pre-emergent chemical at the same time, thus eliminating an extra operation. This allows farmers to maintain the advantages of a pre-emergent herbicide while reducing their tillage operation. It also allows them to maintain the stubble on their field that will collect snow and prevent erosion. This method of application has also provided the farmers concerned with soil conservation with a choice, both agronomic and financial, between pre and post-emergent herbicide.

One of the main things I have noticed in studying soil sample information over the past ten years or so is the effect that summerfallowing seems to be having on our nitrogen levels. Even though available nitrogen levels fluctuate dramatically from year to year and field to field, I feel that if averages were graphed, they would show a steady decline in nitrogen levels. In the same light, my more continuous cropped stubble fields are showing a levelling off of nitrogen and, if graphed, the average, I feel, would show a gradual rise in available nitrogen reserves. It is therefore our conscious effort to promote extended crop rotations and less summerfallow.

I was pleasantly surprised this year by our increased acreage under chemical fallow. In our area, we went from just under two thousand acres under some form of chem-fallow or minimum tillage in 1984, to well over five thousand acres this year. This increase was due to a number of factors: It was a dry year and very few applications of chemical were needed and therefore costs were low. The dry year also helped to establish the need for conserving what moisture we had. There is an increased desire to seed winter wheat and chem-fallow helps to keep that option open. Our dealership promoted a chem-fallow group with the help and financial assistance of several chemical companies. This group was made up of ten farmers throughout our district. We would meet and plan projects to compare conventional summerfallow practices with chemical and minimum till fallow. By the end of next year, we hope to start getting some cost and yield data on these projects to use throughout our area.

Another factor that increased our chem-fallow acres this year was that the Agriculture Committee of one of our rural municipalities and the P.F.R.A. established a program to assist in soil and moisture conservation. The areas to be addressed in the four year program include chemical fallow, salinity recharge and discharge areas as well as water run improvements. This project should prove very valuable to our area. As a dealer, I have provided some of the participants in this project with information and budgeting assistance on chemical as well as fertility programs. A point of interest in regards to the effect that an input supplier can have on projects of this type is that ten of the first fourteen applications this project approved were customers of mine and five of these were participants in our chem-fallow group.

As you can see from this example, there is a role to be played by the input supplier in federal, provincial, municipal and local levels of soil and moisture conservation initiatives. The dealer has the contact with the farmer to pass on technical information and new ideas. He has the equipment available, as well as the ability to put in place any new equipment needed to facilitate a rental or custom application type program. The dealer has to be considered as a relatively inexpensive way for governments to increase technology transfer and to participate in or initiate projects because he is there right now doing these things on a daily basis. To be a dealer today you have to stay one jump ahead of your competition, two jumps ahead of your banker and three jumps ahead of your customers. By being a leader instead of a follower in soil degradation solutions, a dealer can possibly gain a jump or two and therefore have the incentive to participate.

To date, much of the information and ideas a dealer receives on soil and moisture conservation is from chemical companies. They have, by way of promoting their products, done much to influence the dealer in his sales role. Technical information and assistance, although generally product related, has been good. Companies have been spending a lot of money in areas such as chem-fallow research. They have made a lot of headway in developing products, as well as in research on areas such as yield data, increases in moisture levels, economics and soil residues etc. I would like to use as an example Hoechst Canada Inc. Hoechst has spent a tremendous amount of time and money promoting the "Conservation for Profit" Program. This is an excellent program and contains virtually no product promotion. Hoechst produced a manual, three booklets, an excellent movie and a number of television shows on this very subject. This material is available free of charge to farmers, dealers, ag-extension etc. Governments should openly recognize and support efforts of industry involvement such as this. Government programs directed in the area of soil and moisture conservation would be missing a very valuable resource base if they did not include the chemical companies that are so heavily involved in this area.

Recently, there has been a lot of interest generated in the area of chemical registrations and patent protection as they relate to farm chemical costs. As a dealer, I do not have the ability, nor the desire, to defend or condemn the

companies' pricing of agricultural chemicals. I so wish to say that, as a person who handles these products on a daily basis, the research done on these chemicals for their registration helps to ensure my customers, my staff and my own safety. I would also state there is, and will continue to be, an every increasing demand for more diversified, improved and safer chemicals as we increase our fight against soil degradation. It is my sincere hope that when governments, farmers and industry sit down and plan the policies for this area, that safety and research are major factors on everyone's mind.

Formal training of the input supplier by extension people and/or government personnel directly involved in soil and moisture conservation has, to date, been virtually non-existant. Extension people, as well as federal and provincial agencies, have overlooked the role of the input supplier, not only in the field of soil degradation, but in most other areas as well. Often a dealer's ideas and recommendations seem to be in conflict with those of extension people. In some cases, we find extension people openly disputing our recommendations simply because they don't exist in text books, yet at the field level they may be tried and true methods. I am certainly not saying that the dealers recommendations, the experimentation and/or the new ideas being used in the field today are always right; however, the training and experience of the dealer has to be recognized.

As I mentioned earlier, the information and technology that a dealer uses in his business today comes from a number of sources: chemical and fertilizer companies, leading farmers, trial and error, as well as from formal and informal training. The Western Fertilizer and Chemical Dealers Association conducts several events throughout the year where training seminars and formal classes are held. We hold an annual convention and trade show at which we have a wide variety of seminars for the dealer to attend. Our summer Technical Session is mainly a training oriented program in which the dealer can be brought up-to-date on new ideas and programs throughout agriculture.

One of the people we have regularly called on for presentations at our seminars is a person who spoke at this conference yesterday, Dr. Don Rennie. Dr. Rennie has been a leader in western Canada in addressing soil degradation problems and his input to the dealer has been very beneficial.

Each year, our Association conducts an intensive four day course for the dealer and his staff in which, upon completion, the student receives his Provincial Pesticide Applicators Licence. Along with licencing, many other topics are covered such as industry safety, soil and plant science, equipment calibration and maintenance, along with different aspects of business training. For the past eight years we have held this course at Olds College, in Olds, Alberta. In this our ninth year, we have moved the course to Assiniboine Community College, in Brandon, Manitoba. It is our plan to alternate the course between Brandon and Olds, with the possibility of including Saskatchewan if a site with suitable resources can be found.

Our Association would like to offer support to government projects that we could assist with or participate in. We would call on government and extension people to use our technical sessions and training seminars to help us learn more about these matters so we may be more aware and better equipped to help our customers. We have a quarterly magazine and a regular news letter that have a circulation of over twenty-eight hundred. These publications could be used to get information on soil and moisture conservation out to the dealer. Our Association would also lend its support and participation in organizing specific dealer training seminars. We are anxious to learn, if someone is willing to teach.

Committees set up to study or actively address soil degradation whether they are federal initiatives such as the P.F.R.A. conducts, provincial or municipal projects, or grassroots local organizations, would, I feel, benefit from the participation of the input supplier. His experience should allow him to offer a wide range of information on chemicals, fertility, costs associated, as well as a good knowledge of what works and what doesn't in his area. The input supplier also has the greatest contact with a large percentage of the farmers in his area, which should prove useful in the technology transfer process. I am sure most dealers would be very anxious to participate in committees of this type at the local level and I would offer our Association's participation, if required, at the federal or provincial level.

In conclusion, I would like to generalize somewhat and put together several of the thoughts I have had in preparing this presentation for you. In researching this subject over the past few months, I have read many

reports and books that, as I said at the outset, have shocked me as to the seriousness of soil degradation in Canada. If we assume that the predictions made by our soil scientists are true, and I have no reason not to assume so, then, if land use continues with its present methods, eventually, somewhere down the line, we will be left with a very unproductive land base. When this happens, we will be faced with expensive food, supply shortages and Canada could become an importer of many of the commodities it now produces. Once we reach this point we, as the Canadian public, will have very little choice but to provide the farmer with the research and the economic incentives to control and reduce soil degradation, with the hope that it will not be too late. It seems, then, to make sense to invest in research and incentives now, not only as an investment in the farmer but also as an investment in our future for all Canadians.

# FOOD SESSION

## Food in the 80s – new stores

*A.G. Wilshaw*

Ladies and Gentlemen when I was asked to speak at this conference I must admit that my first reaction was one of surprise. Surprise because I think it is fair to say we in the retail food business do not tend normally to view ourselves as part of the agri–food industry. We perhaps tend to see this as being made up of farmers and processors and yet as retailers of course we are a large part of the industry and the only sector which deals with the public who purchase our products. Ahead of anybody else in the agri–food system we very quickly become aware of changes in consumer buying habits that can have a traumatic effect throughout the distribution system from wholesaler to processor to farmer.

I would therefore like to use this opportunity to touch on a number of bases relating to the whole food industry, particularly from the perspective of the independent grocer whose interests I represent.

First of all if we can be permitted to jointly pat ourselves on the back as an agri–food industry it is worthwhile noting that Canadians allocate only 15.8% of their personal disposable income towards purchasing food products whether they be consumed in restaurants or cooked and eaten at home.

This is the third lowest expenditure in the world after the United States and Netherlands.

When one considers the geographic size of our country and small population base, the provision of food at such a low cost to Canadians is a remarkable achievement.

Some may say that this cost efficiency is being achieved at low profitability, for farmer, processors, and food retailers. From time to time we hear complaints from farmers that prices should be lower at the retail level. All I can say is that an industry survey carried out in 1984 showed the average net profit before tax taking all food stores in Canada was 1.42%.

The Canadian agri–food industry in addition to being operated in a most cost efficient manner is also a major employer of Canadian people. Out of a labour force of 11 million people approximately 1.6 million or 14.7% are employed in our industry.

Of this number three hundred and two thousand are employed in food stores at the retail level.

Retailing is, and always will be, one of the most competitive ways to make a living.

It has been said that there are characteristics common to all successful retailers. The number one rule of retailing is humility. When you think you've got it figured out – watch out!

We have many excellent examples in North America of retailers who had it figured out.

Witness the rapid shrinkage of the once predominant U.S. supermarket chain A&P in the 70s.

Witness the demise of Dominion stores in the 80s.

Witness the 1985 withdrawal of SafeWay from Canada's largest grocery market in Ontario.

Witness Loblaws pull out of Western Canada.

Past history and present market conditions suggest change will continue in our industry at a rapid pace and both processors and retailers are going to have to be exceptionally nimble if they are to avoid extinction.

At the retail end ours is a crazy industry. Overall tonnage growth for the last three years has run at 2% or less and there appear to be no prospects for higher levels of growth. In fact if we consider population growth trends, an aging population base, the sedentary nature of our present lifestyle, and the fact the average person consumes 3000 calories a day but only needs 2500. A good case could be developed for suggesting that food tonnage consumption in Canada may well decline over the coming years.

Despite this dismal scenario and excessive food retailing capacity through some 33 100 stores, we are now investing huge sums of money through constructing more food retail space in the form of giant super stores.

It has been said that these mega stores carrying a wide range of food and drug products are the stores of the future. However, as George Condon, editor and publisher of Canadian Grocer stated "the problem in the grocery store industry is that the future is seldom more than 5 years

long". These stores will certainly need to survive longer than 5 years if they are to pay back their substantial capital investment. Some have said that this latest building wave of super stores is ego expansion. If we use the analogy of a war it may well appear that the chain stores have finally become tired of the steady losses of market share given up to the guerilla independents and have decided to counter with the heaviest artillery money can buy.

If market share gain is the only criteria for measuring success then the super stores built in western Canada have certainly done very well. In one year two "Real Canadian Super Stores" in Edmonton have captured 17% of this city's $723 million dollar food market. The formerly dominant retailer in this market, SafeWay, saw their share slide to 59% in June 1985 from 71% in August 1984. This occurred despite SafeWay opening two "Food for Less" super stores of their own.

Similar dramatic results have been obtained by the five real Canadian super stores in Winnipeg and two in Saskatoon. Another super store is scheduled to open in Regina in February and the first Ontario Loblaws Super Store with one hundred and ten thousand square feet of selling space and one third of all items carried being non-food, has just opened in Pickering, East of Toronto and is to be followed by a second outlet in Burlington which should open in February 1986.

It is felt that Ontario offers a minimum potential for 10 super store outlets including 6 in the Toronto area. The Maritimes may well attract a further 3 super stores.

These super stores will have a devastating effect on the food retailing business wherever they are built. However, the real problems will come if egomaniacs build more super stores than a market is capable of absorbing to the point where none of the super stores is viable. We have seen some indications that this may have occurred already in the Montreal market where volumes from super stores are understood to be dropping rapidly to levels which appear to make the stores of questionable financial viability.

The major appeal of the super stores from a consumers stand point lies in their promise of significantly lower retail prices. In a sense they are the creation of a food industry where price lists have become redundant due to an almost perpetual state of discounting and dealing. As Al Graham of Oshawa Group stated "the sheer extent of trade deals both in numbers and depth of case allowances is particularly responsible for the strategy behind many store format changes."

What if the present trading environment was to change? Would this precipitate the collapse of super stores like dying dinosaurs across the country? This remains to be seen.

However, before many of these super stores have even left the drawing boards news has now hit the business press that the food industry will face a new form of retailing which has apparently been most successful in the United States. Steinbergs are scheduled to open the first of several food and goods wholesale warehouses. These stores like super stores will occupy about 100 thousand square feet of selling space and will sell 3000 brand name food and general merchandise products to independent businesses of all types with an average mark-up of 8%. Individuals will also be able to shop at these stores paying a further 5% premium on goods purchased.

It is estimated that 40% of all sales will in fact be to individuals with food accounting for some 20% of total store sales which are targeted for 100 million dollars a year.

This would seem to be a natural vehicle with which Steinberg's will attack the Ontario market where to date they have not been a significant retailer.

These two new up-starts on the retailing block will now join with their cousins the convenience stores; box stores; produce discount stores; traditional supermarkets; fresh food super stores; fresh food terminals; speciality food stores offering fruits and vegetables, meat and bake goods; health food stores; drug stores; department stores; gas stations and other non food outlets all selling food products to an increasingly schizophrenic consumer.

It is these consumers voting with their feet who will determine whether all, some, or none of the above, will thrive into the future. This is a consumer who has changed significantly from the 50s, 60s and 70s. Today's consumer lives in a multi-choice society. In the old days baths were white, telephones black and ice-cream vanilla and vanilla. Today everything comes in 31 flavours including the kind of store where they may choose to purchase their food products.

This is the consumer who will scan the food ads to find the store offering the lowest prices on staples such as: milk, bread, sugar and eggs. At the same time they will visit the in-store deli to

the same time they will visit the in-store deli to purchase their black forest ham and imported gourmet cheeses without a second thought about the costs.

This is the consumer who impatiently stands by the microwave oven cursing at the slowness with which the seconds tick away as their dinner is cooked. Given this environment how can we best summarize what the impact will be over the coming years on the various agri-food businesses.

First of all we can clearly expect the retailing scene to remain extremely competitive. The impact of super stores will create a significant level of turmoil particularly as they open up in the Province of Ontario. Severe pressure will be placed on the bottom line of many retailers and wholesalers as they fight to protect their market share.

From a retailing stand point one would certainly want to be entering this uncertain period with a strong balance sheet because inevitably there will be casualties.

From a farming and processing stand point the pressure to obtain increased discounts will likely grow. It will certainly not get any easier.

Various consumer food trends which have developed over the past few years will undoubtedly continue. Health and weight conscious consumers will continue to turn away from butter, cheese, milk and beef in favour of chicken, fish, yoghurt, fruit juices, and high-fibre cereals.

Sales of fresh produce will continue to expand and grow in importance in their share of total super market sales.

Consumers will demand variety, quality and freshness. They will continue to shop for *value* but will pay a premium price providing the quality is in the product.

Retailers will be devoting ever increasing amounts of their store's space to the retailing of fresh produce because it represents a growth area with a high profit margin. Furthermore it is an area where a retailer can clearly demonstrate the superior nature of his operation versus a competitor. He cannot do this when he is selling packaged consumer goods which are identical regardless of the store in which they are purchased.

Retailers will be demanding from their produce suppliers a larger product range and educational information so that they know how to store, prepare, retail and cook the products concerned.

Canadian farmers will be asked to up-grade the quality of their produce to meet the high standards of quality and packaging given by American competitors.

Retailers ask me. "Why does Canadian lettuce and celery come into the store in poor shipping cartons and in a dirty condition?"

From a retail standpoint regardless of the new store formats entering the market place. Those operators who follow a consistent operating philosophy featuring goods of the highest quality, at fair prices, in clean attractive surrounds – in other words those offering the best value for money will continue to thrive.

This has been the approach taken by one of the most successful retail food chains in the world namely the Sainsbury group in the United Kingdom who hold 15–16% share of market.

They are not the cheapest. They are not the biggest. But they may very well be the best. As as result their business is on a continuous growth path and they are very profitable. Consistency of operating philosophy and finding your own market niche may well prove to be a sounder business approach than flirting with expensive new-fangled retailing approaches. Time will tell.

Thank you again for this opportunity to speak to you this morning. If you have any questions I will try and answer them.

# Food in the 80s – new products

*M. Knox*

Let us begin with painting a picture of today's consumer:

5:00 o'clock. Susan throws on her coat and rushes to catch the bus home. Reading the latest article on baby boomers, she smiles as she recognizes similarities. At 30 she is one of some 79 million people born between 1946 and 1964 – back when the economy was thriving and parents with memories of the great depression, world wars or both tried to buy the best for their children. Tonight, before dinner, she needs to go grocery shopping.

Not enough time for a list, she thinks. She grabs the coupons from the refrigerator door, leaves a note for her husband to pick up their sons after work and rushes out, still dressed in her work clothes.

At the store she lingers longest in the produce section, stocking up on vegetables. Moving quickly down the aisles, a name brand, all–natural cereal catches her eye and she grabs it. At the meat counter she buzzes the meat cutter and asks for a stir–fry beef. She rushes through the rest of the store and finds the coupon items and decides she has enough for the next 5 days. After all, she can come back at the end of the week.

Driving home, she suddenly remembers that the family needs bandages. She whirls to a stop at the local convenience store, picks up the bandages and arrives home – where her husband and sons are waiting. It is 7:00 P.M.

Today's consumer is captured by this scenario I borrowed from the Food Marketing Institute in the United States. Every consumer will not fit this pattern, but several trends are evident and provide marketers with direction. You will note the age and stage of Susan. The frequency and timing of her shopping trips and her employment status. In the grocery store, her affinity for fresh produce, high–fibre foods and special cuts of meat are noted as is her use of coupons.

When we look at today's consumer, we know that the growth of our total population and the market is slow. The population is aging and a key group for marketers because of their size and buying power is the age group in the 35–49 year category. There are fewer teens for companies to cater to. Yuppies are in no need of elaboration having been chronicled in professional marketing journals all the way to the cover of people magazine. According to the "Lempert Report", a newsletter devoted to marketing analysis, "A new species of demographic wildlife is being defined". The Yuppie. This group represents in the U.S. as much as 40% of the baby boomers and their salaries are less than ten thousand a year giving them the less than desirable title young urban failures. The yuppie group has been segmented even further to include the yummy's. This group refers to the young upwardly mobile mothers who were born between 1941 and 1960 and their considerable buying power and taste for consumer products draws them to Christian Dior christening outfits, designer bibs and other high quality products.

We could spend our entire time this morning discussing the characteristics of today's consumer but we will suffice it to say that the consumer today is looking for:

- Quality
- Improved performance in products
- Value
- Convenience
- Solutions to problems, and
- New services

It is important to put the consumer into your mind first whether he/she's a yuppie, yuffie, a senior or whatever, the above factors having meaning and then our discussion of new products will be in its appropriate context.

In our discussion on new products, we will talk about categories of new products. The process by which they are developed, introduced to the trade and ultimately to the consumer and then a look in the crystal ball about what types of food products might be available in the future. For all of us in the agri–food business, future success is based on good product innovated to give consumers what they want.

What's new? Four categories of new products help in understanding what new products are:

Firsts are those products which nobody has ever seen before in its particular form. Firsts would be such items as disposable diapers, anti–static sprays, tofu–based desserts.

Me-too products would be the second or third soft turn-over type cookie introduced into the marketplace as an example.

Alternatives are those products which are clearly positioned to be an alternative choice to those currently available. The influence of nutra-sweet in the marketplace introduced the potential for a different kind of sugarless gum. The fourth category, extensions, refers to new flavours, sizes, colours or packaging of products for example, juices which has been previously sold in cans are now the same product but sold in tetra pack packages.

## Success equals significant difference

The secret to success for a new product is if it can show the consumer the significant difference between that and other products. The difference must be recognizable to the consumer and certainly be a product that the consumer wa..ts or needs. Some degree of familiarity with use of the product is important and the company must be able to communicate the difference of the product well to the consumer. I might add, that an important point is that timing of the introduction of the product is critical. For example, in the disposable diapers situation, their initial introduction in the 1950's was less appropriate than its acceptance in the '70s. The convenience of disposable diapers versus cloth became a more important factor and therefore, the product successful.

## Putting life into the life cycle

We are going to look at the life cycle of any product and then specifically focus in on the introduction and primary growth of new products.

In the slide you will see the primary growth cycle that represents approximately two and one half years from first introduction. This is an average development period for any new brand. The graph indicates a positive picture of a very successful brand. You can also see that some products rise quickly and then fall off just as rapidly even before the two and one half year period is completed.

## Marketing concept

As I said in my introductory remarks, putting the consumer into perspective and understanding their influence on development of new products is key to understanding new product development. A little history on the development of the marketing concept. At the end of World War II, marketers found that they could sell almost any package of goods they produced to consumers who had long done without because of the demands of the war. Once consumers had gone past the novelty of having a variety of products made available, they began to exercise discrimination.

At this point, many companies jumped from a product orientation to a selling orientation.

## A marketing-oriented firm tries to sell only what the consumer wants

Finally, in the early 1950's many marketers began to realize that they could sell more goods, more easily, if they produced only those goods that they had already determined consumers would buy.

Instead of trying to get consumers to buy what the firm had produced, a marketing oriented firm started to sell only what the consumer wants.

Thus, consumer conceptions became the firm's primary focus.

## Prenatal stage

In the life cycle of any product, the pre-natal stage is determining what the consumer wants and needs, and from there, ideas to meet those consumers needs are developed. Qualitative research takes place with groups of consumers to test out new ideas.

## Concept boards

Concept boards are developed on ideas that have gone through the pre-natal stage. When I say concept board to you, construct a picture of a large board that describes a product, how it could be used, what its potential price could be, what the packaging could look like.

If the product is perceived as being a potential winner, the product is then developed. It is tested in a comparison with other similar type products with which it would compete. At any stage in new product development, an idea can be turned down if it is thought the market is to be less than accepting. At this point, we might stop and say that maybe oomparison with other similar type products with which it would compete. At any stage in new product development, an idea can be

turned down if it is thought the market is to be less than accepting. At this point, we might stop and say that maybe one out of 100 ideas generated in the pre–natal stage ever makes it through the labour pains into the test market.

## Plan the announcement

Companies plan for the birth announcement of a new product both to the trade and consumer but they also plan for recycling of the product at year 2, 3 and 4 in order to continue stimulating growth in sales. Since the introduction of a new product has two customers, first the retailer, then the consumer, lets take a look at each of these groups.

## Trade

When a sales person with a new product goes into meet with a retailer, information is provided on what the new product is, what types of products it might compete with, the potential for consumer acceptance and certainly the potential profit to be realized to the retailer.

When we consider the mechanics of listing a product what this means is first of all the retailer decides whether the potential market, competitive activity and types of promotional support provided by the manufacturer warrant listing the product. Grocery store shelves are full today. In fact, as one sage of the retail profession said: "Twenty years ago they said the shelves were full".

Its true, the shelves are full with 10–15 000 items and in order for a retailer to have a new product in his warehouse and then move into rearranged space on the grocery shelf costs the retailer money. Money is made available to the retailer by the manufacturer to assist in the mechanics of warehousing and distributing a new product. Newspaper ads – every Wednesday you see in your local newspaper ads from your local grocery stores. New products are often highlighted in these ads and manufacturers make money available to promote new products in this way.

Store displays – end aisle store displays are made available as a way of highlighting a new product.

Specials – specials are offered for new products and other products at a reduced price to draw the consumers' attention to it.

## Consumer

There is a variety of methods whereby the consumer learns about new products in the grocery store.

Advertising – certainly advertising through television, radio and print media are all common examples. As the consumer becomes more diverse, specific targeting of messages to specific markets is seen.

Coupons – coupons presents an opportunity for the manufacturer to give directly to the consumer a reduction in price on a product. Coupons can be received inside a package, by the mail, in the newspaper or in magazine advertising.

"Live" sample – the "Live" sample provides the consumer with an opportunity to try the product before actually going out and buying it. Direct homw delivery of new products is an expensive and potentially very successful way of drawing new products to the consumers attention.

To repeat a comment made at the outset of the speech, those products that become successful are those that demonstrate a recognizable, wanted and somewhat familiar difference between itself and other products.

## Results

The primary growth of a new product is about two and one half years. From the life cycle outline, you understand the conception of new products is consumer driven. The prenatal development of these ideas follows a test plan. Until a new product is born or presented to the retailer. Many new listings have a 90 day period once they reach the store shelf to perform. I thought it might be useful to go back to my original examples of the different types of new products and look at some performance results.

I thought it might be interesting to go back to a product that was new many, many years ago. Which is still in the market place today, but has had its ups and downs.

## Product innovation

On this case history, we look at a branch that dates back to the 1930s. It is not evident on this chart, but the number 2 brand was market leader for 20 years until a new competitor entered the picture in the mid 60s and assumed market leadership almost immediately. During the last 10 years, the manufacturer of the former market leader became very aggressive in attempts to increase market share while being mindful on new competitive entries along the way. Through constant maintenance of the brand during the past 20 years and product innovation, this manufacturer has recently recaptured the role of market leader. This slide not only demonstrates the long term challenge to any new product that is introduced but shows the need for planning and recycling of market plans.

### Me–Toos

The second category of new products are me–too type products that are similar to ones already in the marketplace.

### Flanker brands

The manufacturer of this brand has been active since the 1800s. His brands are kept up to date by incorporating improvements in original brands and also introducing new brands in the same category. So this is an example of a manufacturer actually allowing his original brand to compete with three new flanker brands of his own making.

### Alternatives

The alternatives category of new products was exemplified by the sugarless gum category. In the next example, we will see a similar kind of market place example.

### Reformulation

In 1981, technology developed to the point where new sweetening agent entitled aspartame was approved for use in Canada. From 1977 no artificial sweeteners were permitted for use in manufactured food products in this country. Prior to that time, dietetic products had used cyclamates and saccharin as an alternative to sugar. The presence of aspartame in diet soft drinks has allowed the segment to represent 20% of the entire soft drink market. In fact, the entire soft drink category has moved up in its consumption.

### Extensions

Extensions is the fourth category of new products and as mentioned earlier, includes new flavours, new colours, new sizes and new packages of existing product.

### New packaging

Market segmentation has been made possible in recent years by new technology. Many times a new technological development will dramatically increase the perceived future potential of a brand.

A current example of the effect of technological change on a category would be the introduction of aseptic packaging to the fruit juices and drinks category. At the end of five years, aseptic containers accounts for almost 25% of the total category of sales and has put new life into a "sleepy" product category. You can see from the slide that the growth of juices and drinks in the tetra pack packaging is growing at an impressive rate. As an aside, the size of packaging is subject to regional preference. For example, the small individual tetra pack containers of fruit juices moves very well in the east and not the larger one litre sizes; whereas these larger one litre size moves very well in the west.

From these results, you can see that new products can have a long life provided product innovation is well managed. Flanker brands are developed and can help the growth in the entire category. Reformulation of products can bring new life to an entire segment of products as with the diet foods as can new packaging.

## Necktie products

What lies ahead? I thought it might be interesting to look at someone else's view of future trends that might affect food consumption. Recently, in an article in May of this year in progressive grocer, the senior vice president of the William Estey Co., Tom Hayes, reviewed the changes he sees coming in food product consumption.

He indicated, that in hiw view, in the U.S. that food product consumption changes are only beginning. He said: "Food is rapidly moving from being just a 'passive necessity' to a 'necktie' consumer product. 'Nectie' products are those which consumers use to define 'who they are' to themselves and to others.

Consumers shopping grocery aisles are ultimately making a statement about themselves ... Smart enough to avoid salt ... Frugal enough to use double value coupons ... Contemporary enough to know about Kiwi Fruit ... and sophisticated enough to make moroccan couscous.

The rate of change in consumption patterns is being accelerated by this use of food as an inexpensive and highly visible symbol of personal expression." Tom goes on to predict 15 future trends in food consumption. He notes that one sure thing that is happening is that food habits are changing, he thinks 15 of the changes upcoming are the following.

### International foods

Ethnic foods will continue to emerge. The first was Italian, the Mexican and the next will likely be Caribbean or Polynesian.

### Solids to liquids

Diet is shifting from solids to semi-solids and liquids. Beverage forms in terms of nectars, digestives and even liquid meals will become more important. "Tube Foods" - in squeeze packages with flavour pastes and condiments are popular in Europe.

### Fruit-based product extensions

Jerky, pressing, spreads and crisps will be part of this new expanded category.

### Oriental influence

The healthy/natural food area will be continually influenced by tofu, rice, seaweed, ginsing and tamari.

### Palate shift

Palates are shifting from blah to wow as higher flavour levels are being experienced in both food and drink. The influence of the changing demographics in Canada is recognized in the Asian composition and resultant "spicy" flavour preferences.

### Textures new role

Single products may come in various textures just as we now see the same product in various flavours.

### Side dishes

The decline in numbers of side dishes will now reverse and entrees will have a greater selection of accompaniments.

### Home growing

Window boxes including herbs, spices, small vegetables and fruit will continue to predominate in the home situation.

### Temperature drop

A greater percentage of products will be eaten at cold or at room temperature requiring more items which will be produced in the refrigerator.

### Small meals

The eating on the run society may well develop the European pattern of having a fourth snack time/meal time or break time along the pattern of the Europeans.

### Acid adjustment

A series of low or no-acid products will continue to be introduced.

### New ingredients emerge

Different ingredients may emerge for broad scale commercial use including terminalia which is a wild fruit that contains 50 times as much vitamin C as oranges; dahlia tuber a caffeine-free, non-acidic base for beverages and amaranth grain which is high fibre protein and vitamin content.

### White meats go exotic

The nutritional advantages of various white meats may cause them to be positioned under different names but nonetheless will originate with cat fish, frog and rabbit as examples of commercially raisable white meats.

### Price polarization

Shoppers may develop a tendency to save money on certain products by buying the least expensive item in a category in order to afford the most expensive item in another product line.

### Food binges

In the consumers' desire to avoid certain foods it may result in periodic binging for short periods of time in order to not exclusively eliminate products but as a different style of moderating product use.

We could debate back and forth whether we would agree with the specifics of the trend, but I think it is interesting to think of the new product implications.

### Crystal ball says

My crystal ball says that the trends we are seeing now will be translated into a variety of products. Dairy by-products certainly are seeing a lot of growth in the European markets and we have the same potential in Canada. The convenience the consumers are looking for and the continued growth of microwave sales will naturally lead to microwave meal components. Dinner entrees and full meals are available and perhaps the next steps are mix and match meal components. Variety grain products are obvious and as the health implications of grains are better understood, innovation in this category will continue.

Designer apples were recently highlighted at the taste show at the New York Coliseum in October. The price of these products rivalled out-of-season melons. The reason for the cost was due to the circumstances under which the apples were grown. They are unsprayed and all natural resulting in time consuming hand work. These apples are bagged on the tree to keep them from turning red. They are then treated with light to turn them red everywhere except where a stencil has been placed for a variety of messages on the apple. This is an extreme example perhaps of designer fruit, but the quality issue of produce will continue to receive attention.

Healthy, mobile long life snacks are obvious pluses for consumers who graze their way through the eating day. Another fun example of a new product is trivia bits which are cheddar cheese crackers stuffed with trivia questions inspired by the infamous trivial pursuit game. It is an alternative, perhaps, to fortune cookies.

Finally, 'Cadillac desserts'. I am *not* suggesting that consumption of desserts will increase in the future. So even for those people who are watching their diets carefully, they will still choose to have desserts and will look for high quality ones on which to spend their calories. The 'stinge and splurge' approach to desserts, you might call it perhaps saving on some 'light' foods while splurging on the 'cadillac desserts'.

## What's new?

Each of us has our own ideas about what new products will be seen in the future. You may think about more homemade/handmade products, 'welldarly foods' for the healthy senior, this list could go on and on, one thing is for sure: consumers are coming up with new ideas today which will be translated into new products tomorrow.

# Food in the 80s – new experiences

*R. DeGrace*

It's a pleasure to be here today to talk about Canada's restaurant and foodservice industry. It is only appropriate that this conference include a review of foodservice trends. In fact, the foodservice industry is the fastest growing sector of food retailing and presents numerous opportunities for producers and processors who are flexible enough to respond to the rapid changes occurring in our industry.

It is a statement of the obvious to say that Canadians are dining out more than ever before. Statistically, Canadians have increased their expenditures on food away from home from 22% in 1969 to 33% in 1984. Obviously, the restaurant industry is stealing marketshare from the grocers and supermarkets and it will continue to increase its share between now and the 1990s.

Dining out has become part of the Canadian lifestyle in the 1980s. It is more than just a convenience, although that is a contributing factor. It has become a statement of our values, desires and style of living. For many, dining out is an escape from the hectic pace of modern life. For others, it is an international experience featuring the atmosphere and foods of foreign lands in their own home town.

The trends in dining out have been triggered by a number of social and economic factors which have irrevocably changed the manner in which North Americans live. The increased participation of women in the work force has probably been the single biggest factor stimulating growth in the foodservice industry. Their rising status in the corporate world means longer hours on the job and less time at home. It also gives them the money to dine out and exposes them to the urban lifestyles which stimulate the industry.

In many ways, restaurants are an urban phenomenon because our urban centres are meeting places. Restaurants provide an essential facility for visitors, downtown workers and others who are effectively divorced from their homes for long periods of time.

Together these factors have stimulated the growth of an industry which is now one of the largest in Canada. The restaurant and foodservice industry employs 625 000 Canadians in more than 50 000 businesses across the country. In 1985, foodservice sales will exceed $18 billion, an increase of 8.1% over 1984 and a real growth rate of 4.1%.

After labour, food is the biggest cost incurred in the operation of a foodservice business. The typical restaurant spends 27% of its expenses purchasing raw and processed foods. Collectively, the industry will spend $4 billion this year buying food for preparation and re-sale.

This is a very complex industry and, for purposes of analysis, we at the Canadian Restaurant and Foodservice Association break it into 11 different sectors ranging from liquor licensed restaurants to food sold in vending machines. Today, I thought it would be helpful to review the five biggest sectors which account for the lion's share of industry sales.

The biggest sector is *liquor licensed restaurants* which will reach $5.2 billion in sales of food and beverage in 1985. A recent survey by our association shows that the typical liquor licensed restaurant has 75% of its sales in food and 25% in alcoholic beverages. This sector is dominated by the independent operator offering full service facilities and featuring a broad variety of cuisines. With some notable exceptions, like Keg Restaurants and Swiss Chalet, the national chains find it difficult to enter this market. A full service, liquor licensed restaurant, is a complex and demanding operation which requires the commitment of an operator to stay on-site or a superb staff training program.

Ethnic cuisine has become the fastest growing menu item with Mexican, Italian and Cajun foods representing the fastest growing items.

The second largest sector in *unlicensed restaurants* which will reach sales of $3.3 billion this year. This sector is dominated by the fast food operators which are led by large national chains. These fast food chains feature limited menus specializing in specific foods like burgers, chicken and pizza. Because their menus are limited, they can systemize the preparation of food, maintaining quality control and standardized counter service.

This sector has shown the fastest growth in the last decade because it fulfills some crucial needs in our modern society. It's convenient, quick and inexpensive. For those reasons, location is a prime consideration to this sector and wherever you find large volumes of people and traffic, you'll find these fast food chains.

In the 1980s, we've noticed an inverse relationship between the sales of the liquor licensed sector and the fast food industry. In 1982 and 1983, during the depths of the recession, fast food sales grew an average of 12% per annum at the same time as liquor licensed sales grew only 4%.

With the improvement of the economy in 1984 and 1985, the rate of increase in liquor licensed sales has consistently grown while the sales increase in fast food restaurants has flattened out to the rate of inflation. In 1985, liquor licensed restaurants are experiencing a 10.6% increase in sales while unlicensed restaurants have dropped to a growth rate of 4.9%.

We call this phenomenon trading up and trading down. In the tough times, when unemployment is high and disposable incomes are low, people trade down to the less expensive restaurants. They don't stop dining out, they just stretch their food dollar. In the good times, they trade up to full-service restaurants with higher menu prices.

The third largest segment of our industry is the *institutional sector* which features meals prepared and served in schools, hospitals, prisons, factories and old age homes. This is a steady but unspectacular performer in our industry. We project that institutional sales will reach $3 billion this year.

We also project continued growth in the institutional sector due to the aging of the population and the need for increased health care. Because of the steady growth potential in the institutional sector, we expect to see efforts to penetrate this market by the fast food chains who are constantly seeking new opportunities for growth. In the United States, for example, MacDonalds has a contract to build 400 units on U.S. navy bases around the world while Burger King is erecting 200 units on U.S. army bases.

The fourth biggest sector in terms of foodservice sales is *accommodation establishments* such as hotels, motels and resorts. This sector will reach sales of $2.6 billion in 1985 which is a 9.4% increase over last year and slightly better than the industry average of 8.1%. Sales in this sector are directly related to occupancy rates in the accommodation industry which are a function of corporate and leisure travel plus meeting and convention business.

There has been a significant shift in this sector's perception of foodservice. Historically, foodservice was a necessary evil provided as a service to room-buying guests. In the past decade, many hotels and resorts have positioned foodservice as a signature item. They've recognized that distinctive cuisine attracts both room guests and people who are just dining out. They can build their reputation around a quality dining room.

The fifth biggest sector of the foodservice industry is *take-out and home delivery* which represents $1.4 billion in sales. This sector is similar to the fast food business with limited menu items offering the consumer convenience at low prices. It appeals to people who want the convenience of a prepared meal for consumption in their own homes. With the growth of in-home entertainment like pay TV and video cassette recorders, we project substantial growth for this sector.

Those are the major sectors of the restaurant and foodservice industry and some of the trends that are stimulating growth in those specific areas. There are, however, a number of other trends that transcend sector boundaries and influence the industry as a whole.

*Fresh, nutritious and health foods* have become a major priority among today's restaurant patron. This began with fresh vegetables, a trend which our industry capitalized on with salad bars. The concept of fresh vegetables, the visual appeal of salad bar displays and the opportunity to mix and match ingredients added a new dimension to dining out. The trend to salad bars has remained strong and has expanded to include a much wider variety of vegetables and toppings. Today, there is a fascination with all vegetables provided that they are fresh and properly prepared. The consumer doesn't want soggy vegetables. They want a little crunch because that tells them it's fresh.

In the United States, the fastest growing menu items are fruit as a side dish, juices and decaffeinated coffee.

The consumer in the '80s defines nutrition and health as thin. As a result, portions are shrinking. Thirty years ago, you judged a restaurant by its large portions. Today, a good restaurant features small portions. We get more complaints about serving too much than we do about not serving enough.

The desire for health, nutritious and light foods has resulted in a move away from red meats to chicken and fish. Right or wrong, this trend is expected to continue with the result that chicken will outpace red meat by 1990.

Obviously, our beef farmers will have some very real challenges in the coming decade. Their market won't disappear because there are always certain segments which will specialize in beef. But the growers and the producers must move to leaner, quality cuts and they must identify market opportunities.

The demand for fresh fish in the restaurant industry is skyrocketing but there is a tremendous disparity between what today's customer wants and what is being provided by the fishing industry. Fish holds a lot of opportunities for the restaurant industry because the consumer has difficulty finding the products they want and preparing them properly. Specialty seafood and fish restaurants can do a better job and offer a wider variety as long as they can get a high quality, fresh product.

Today's restaurant industry is a dynamic and growing sector of the economy because it is driven by consumer demands and tastes. And today's consumer is a very sophisticated and adventurous restaurant patron. We are no longer a meat and potatoes society. In fact, I don't think you can characterize our country by any particular food. Canadians are willing to try new foods and they are increasingly caught up in the process of experimenting and experiencing tastes.

Cooking methods are changing in response to both health concerns and the desire to experiment with new tastes. We're seeing less frying and more baking, broiling and barbequeing in restaurants. Some restaurants feature exotic charcoals; such as, mesquite or hickory, in order to give the consumer a unique flavour to old favourites, such as, steak and burgers.

Not only are consumers changing what they eat, they're changing how and when they eat. Fewer and fewer people in our urban society are eating three square meals a day. Instead, they're combining breakfast and lunch into brunch or snacking throughout the day with no identifiable meal period.

In the restaurant industry, we've identified this trend as "grazing". During the day, consumers move from restaurant to restaurant ordering an appetizer at one, a sandwich at another and dessert at a third. These grazers necessitate expansion of menus to include a better selection of items; such as, appetizers, cheeses, fresh fruit and desserts.

Canadian lifestyles continue to change and that is keeping our industry on its toes. At CRFA, we project a number of trends which will dominate the foodservice industry between now and the 1990s:

- Canadians will continue to seek healthy and nutritious foods;
- people will be drinking less liquor and more juices and other non-alcoholic beverages;
- Canadians will continue to become more sophisticated in their eating habits, seeking a greater variety and higher quality of cuisine. But they will always want good value wherever they're eating;
- the demand for vegetables, salads and poultry will grow stronger; and
- pasta, fish and seafood will continue their popularity.

If I leave one message with you today, it would be that there are more opportunities for growers and producers than ever before. There is no longer a mass market in our industry but there are many more market segments.

The agrifood industry must become more flexible so that it can serve the numerous market segments in foodservice. The growers and producers must learn to specialize in those areas where they can excel, producing a unique and high quality product.

Ladies and Gentlemen, I have enjoyed this opportunity to address this conference. I hope that I've given you some food for thought and that you will have gained a greater insight into the nature of Canada's restaurant and foodservice industry.

# AGRICULTURAL SOIL AND WATER SESSION

## The on–farm economics of soil conserving production practices – situation and outlook

*H.T.M. Colwell, D.H. Culver*[1]

### INTRODUCTION

Other conference papers address various dimensions of the soil degradation problem. This paper concentrates on potential technology based *SOLUTIONS* which could be adopted at the farm level. Specifically the paper provides an overview of:

- the range of *technologies*;
- the *information needed* by farmers who are considering adoption of these technologies;
- the types and sources of *information currently available*;
- an assessment of the *economic viability* of selected technologies; and
- gaps in the available information.

The importance of different types of soil degradation varies across Canada (Table 1). However soil erosion is an important problem in many regions and this paper emphasizes technologies which reduce it.

### IDENTIFICATION OF SOIL CONSERVATION TECHNOLOGIES

The range of technologies which can limit soil degradation is rather large. Table 2 illustrates some of the possible technologies which have been or could be used to limit the impacts of specific types of soil degradation. In general there are two broad categories of technologies. *Mechanical control practices* involve changes in the types and intensity of cultivation. Research in this area has emphasized the development of various forms of reduced tillage such as zero tillage, minimum tillage and ridge tillage. The second broad approach has been to use *vegetative control measures*. Emphasis within this approach has been on the development of longer rotations which are applicable to prairie farming systems resulting in a reduction in the amount of summerfallow.

### INFORMATION NEEDS FOR ASSESSMENT OF SOIL CONSERVATION TECHNOLOGIES

A detailed assessment of soil conservation technologies should consider environmental, institutional and social consequences in addition to economic impacts. However, in the spirit of the paper title, the discussion here emphasizes information needs for assessment of economic impacts.

Economic changes resulting from widespread adoption of soil conservation technologies will impact *directly* on the farmers themselves and also *indirectly* on the rest of society (Figure 1). Indirect impacts include changes in employment and income for the input supply businesses which produce and distribute the soil conservation technologies and to the businesses which market the increased level of production (grains, forages and meat) available from farmers. The economic impacts resulting from adoption of soil conservation technologies are likely to occur both in the short and long term, with an emphasis in the longer term particularly for factors such as the market value of land.

Comprehensive assessments of all of the physical and economic variables shown in Figure 1 are rare. Usually assessments concentrate on one of three key areas i.e., physical impacts, direct economic impacts to farmers or indirect impacts to the rest of society. The emphasis in the remainder of this paper will be on information needs related to physical impacts and to direct economic impact to farmers.

The farmer, in order to make a rational decision on whether to adopt a specific soil conservation technology, needs to evaluate information on:

- the possible *physical* impacts of this technology on his/her farm i.e. Will it work?
- the possible *economic* impacts of this technology on his/her farm business i.e., Will it pay?

both in the short and long run. The farmer also needs to consider other options such as the increased use of fertilizer as a short run tactic to offset the impacts of soil erosion.

Some of the important physical and economic variables for which information is required are noted on the horizontal axis of Figure 2. The crosses in the body of the figure indicate direct linkages between specific physical or economic impacts and the information needed to assess such impacts.

Several conclusions about the required types of information can be drawn from this figure.

There are important linkages between the physical (soil and crop) and economic information requirements.

For example, it is very difficult to assess the economic feasibility of a specific soil conservation technology without information on the value of crops produced on the land before and after adoption of a new technology. The crop value depends on information on incremental crop yields resulting from the reduction in soil loss associated with the use of that technology on a specific soil.

Much of the physical information required ideally should permit assessment of crop/soil interactions over a significant period of time (because of the importance of long run impacts).

Because of the long run nature of both the problem and possible solutions information is needed on how the on farm adjustment should take place in terms of factors such as cropping plans, cash flow and management skill needs.

## INFORMATION AVAILABILITY

Given the historic significance of soil erosion in Canada and other parts of the world it is not surprising that a large volume of information related to soil conservation exists. Some of the key databases, abstracts and other sources are noted in Table 3.

The large international data bases (e.g., CAB, AGRICOLA and AGRIS) contain millions of document references including, in the case of AGRIS, a certain amount of unconventional (usually unpublished) information. Subject scope of these databases tends to be very broad. Tables 4 and 5 provide an indication of the number of document references pertaining to soil degradation available in CAB, AGRIS and AGRICOLA. Canadian content appears relatively low, nevertheless the number of potentially useful documents from other countries is large.

Among non-bibliographic bases, the Canada Soil Information System (CANSIS) is particularly interesting. It contains largely numerical data in various files. As the name implies CANSIS is more than a simple numerical database; it is a comprehensive system which can be used to create personalized data files, and to manipulate data in various ways.

CANSIS includes site-specific data on crops, yields, soil horizon depths, field characteristics, soil analysis, crop management, weather and other factors. At present, most records in the file do not contain data for tillage and conservation practices, but many do, and the potential is clearly there to incorporate much more of this type of information. There may already be enough relevant data to make possible some very interesting statistical analyses in which tillage and conservation practices could be correlated to yield performance. One study, just completed, used CANSIS to generate physical soil and land use data in the determination of the economic impact of soil degradation in Eastern and Central Canada and Southern British Columbia.

The Conservation Tillage Information Center (CTIC) based in Fort Wayne, Indiana acts as a specialist information service. It was established as a special project of the National Association of Conservation Districts (NACD). The Center was established to facilitate information exchange amongst individuals and organizations interested in Conservation tillage. The Center undertakes a number of activities including coordination of a survey of tillage practices, a referrals to resource people and a monthly newsletter.

Environment Canada operates the Water Resources Document Reference Centre (WATDOC) with 5 databases. These databases contain considerable numbers of primarily Canadian source document references on topics related to water resources, including many about the impact of agriculture on the environment (Table 6).

## ECONOMIC FEASIBILITY OF SELECTED SOIL CONSERVATION TECHNOLOGIES

This section of the paper will concentrate on an overview of the limited number of Canadian assessments of relevant technologies. Soil erosion limiting technologies will be addressed first followed by a brief overview of technologies dealing with other soil degradation problems.

### Soil erosion limiting technologies

The potential economic success of the soil erosion technologies indicated in Table 7 is limited by both physical and economic factors. The three major constraints are soil type, and differential impacts on soil erosion and the farm production system.

### Variability of impact by soil type

While many of the vegetative practices listed in Table 7 can be applied to all types of soils the same cannot be said of all the tillage techniques noted under mechanical control practices. Research involving conservation tillage systems and different soils indicates that these tillage techniques have certain limitations:

- they are not adaptable to all soils;
- yield responses are inconsistent; and
- they require additional emphasis on crop management not associated with conventional tillage.

The yield variability is most noticeable with no–till systems. Where soils are inadequately drained and take a longer time to warm up, the result is a delay in plant germination and most often reduced crop yields.[2] The applicability of particular soil conservation technologies to specific soil groups is noted in Table 7.

### Impact on soil erosion

The impact of a specific technology on soil degradation will vary depending on such factors as topography, soil type, present level of erosion, type of erosion and soil moisture status. Frequently, the best approach in many situations will involve a combination of practices to effectively control erosion (Seecharan, Culver and Murray, 1985). The reported reductions in soil loss are substantial. For example, a no–till system can reduce soil loss by as much as 80% compared with fall ploughing. Tillage and planting of crops on the contour can reduce soil loss by 50% compared with up–down slope (Moore, Ketcheson and Fish, 1982).

### Impact on farm production system

Implementing soil and water conservation practices in some cases involves a substantial change in the farming operation. For instance, inclusion of forage grass or legume crops would imply that a grain farmer could either rear some cattle, find a suitable market for the crop, plough down the crop to enhance the soil productive capability or obtain additional machinery. Inclusion of animal activities in the farming system would also require year round supervision; something which the farmer might be reluctant to do.

Some other soil conservation technologies such as shelter belts and grassed waterways may be relatively easy to incorporate into existing crop based production systems. Changes in tillage systems are also sometimes easy to incorporate into an existing crop production system. However the adoption of these technologies may require substantial quantities of capital which may be difficult to justify in periods of low crop prices.

In *Western Canada* three soil conserving technologies which have been more widely adopted in recent years are:

- reducing the area of summerfallow through use of longer rotations;
- the use of reduced tillage practices; and
- the substitution of winter grains for spring grains.

For example, the area of winter wheat seeded in the Prairies increased from 141 000 ha in 1981 to 709 000 ha in 1985 (Statistics Canada, 1985). Regional and soil factors in addition to market conditions place some limitations on the potential for further profitable adoption of these approaches (Table 8).

Conservation tillage systems (Zero and minimum till) and incorporation of a legume such as sweet clover into the rotation appear to have some economic potential. Available economic analyses of minimum tillage suggest that the economic viability in the short run is heavily dependent on extra input costs (e.g. herbicides for conservation tillage), and the resulting yield

depression (Anderson and Knapik, 1984). Therefore, the available information indicates that the adoption of chemical summerfallow and other minimal tillage systems, on average, results in a financial loss in the short-run compared to the more traditional systems.

It should, however, be noted that, because of the variability of soils, climate and management skills, it is possible for some farmers to successfully and profitably incorporate specific soil erosion control measures in their farms. These farmers have been able to adopt, and in many cases, adapt the technology to their unique situations.

In *Central and Eastern Canada* the use of outlet and sub surface drainage to remove water has been a widely used technology. Several studies have attempted to assess the economic benefits to farmers and to society. In general these studies have shown widely divergent results between farms and between different outlet drains. The economic feasibility of drainage technologies is closely linked to the increased productivity being achieved in practice from the drained land (see Table 8). Attainment of this potential productivity has frequently involved switching land use from low output crops, e.g. hay, to high output row crops such as corn and soybeans. Paradoxically these row crops can provide the conditions that lead to increased soil erosion.

Only a limited amount of technical and economic research on soil conservation technologies has been undertaken in Central and Eastern Canada. A study is currently being undertaken using limited available data and a computer model (called Soilec) to assess the short and long run economic viability of a wide range of potential soil conservation technologies (Seecharan *et al*, 1985). The study focusses on Southwestern Ontario and Southwest Quebec.

Selected results for Southwestern Ontario are outlined in Table 9. The various conservation tillage systems are compared to the base system of fall ploughing in terms of net profit per hectare and soil losses for various systems. This preliminary economic analysis indicates that on a sandy/loam soil returns with ridge tillage and fall chisel ploughing resulted in slightly higher economic returns and a reduction in soil loss. The results also indicated that combining tillage changes with a rotational change e.g., no till corn-soybean rotations may be more economic than either of the changes alone. Other tillage systems such as zero tillage, however, resulted in a reduction of net farm income in the years directly following adoption.

In the longer period of time, however, those tillage systems which are not economical in the short-run may be economical in the longer run. As illustrated in Figure 3, the estimated economic returns of zero-till are $18/ha lower in the first year after adoption, however, twelve years after the adoption returns are higher with the zero till system.

## Other soil degradation limiting technologies

*Acidification* appears to be the soil degradation problem which has a well tested and economicaly feasible solution of general applicability. Economic studies in Western Canada suggest that the *application of lime* to resolve soil acidity problems will give farmers a two year payback (Table 9) (Anderson and Knapik, 1984). Lime is well accepted as a solution to acidity problems in Eastern Canada but the extent of adoption of liming is limited in various provinces by cost, lack of awareness and the production of low value crops. (Development Consulting House 1985).

The use *of longer rotations* in Western Canada and the subsequent *reduction of summerfallow* is being more widely adopted in Western Canada. Adoption of this technology is expected to reduce soil degradation due to *organic matter loss* in addition to reducing erosion. Available analyses suggest that the economic feasibility is limited by yield changes and increases in input costs (Table 10).

Technologies to reduce salinization and compaction are not generally adequately evaluated from an economic standpoint (Tables 10 and 11). However, it should be pointed out that many farmers are applying technologies which reduce soil degradation even though information on the economics does not exist.

## Gaps in the available information

This section will briefly deal with areas where more and better information is needed on *solutions* to the various soil degradation problems. It should, however, be acknowledged that, in addition, much more comprehensive information is needed on the economics of the degradation problem.

The *priority need* to enable the agricultural sector to better evaluate specific soil conservation technologies is to *selectively augment the existing information base* so that farmers have more relevant information for making decisions on whether to adopt specific conservation technologies for their farms.

Two main types of information are required to augment the existing base.

*Regionally specific information on soil–crop–climate–technology interactions* as they impact on economically important variables in the short and long run. Specifically information is needed for representative soil types on:

- the relationship between soil loss avoided by various technologies and the revenue change from the crops grown on that land.
- a better understanding of the extent to which the potential crop revenue loss from soil degradation can be counteracted on a sustainable basis by the use of purchased inputs such as fertilizer.

*Farm level assessment of soil conservation technologies* is required to provide information on a range of factors including impact on:

- suitability of each technology for the soil, climate and farming systems of the region;
- type and level of purchased inputs (e.g., chemicals and fertilizers).
- machinery complement including tillage, harvesting and hauling equipment.
- other fixed costs such as storage and livestock buildings in cases where a forage or legume crop is included in the cropping plan.
- level of management input required including need for scheduling of operations and sensitivity of results to variability in level of inputs or timing of operations.
- the severity of the change required in the farming system.
- availability of markets for different mix of products being produced on the farm.
- farm business performance including income, cash flow and balance sheet aspects with particular emphasis on the phase in period of the soil conservation technology e.g. forage enterprise.

Farmers and farm organisations such as soil and crop associations can make substantial inputs into the identification and assessment of soil degradation technology packages. In addition, it is likely that these farm level assessments will assist in identifying *future* research priorities.

The new information requirements identified above can best be achieved through multidisciplinary studies involving amongst others, soil scientists, agronomists and economists.

A *secondary need* is to *better organise* relevant existing information with the new information into a technology package which can be evaluated by the potential adopter. Specifically there is currently a *lack of regionally relevant and economically proven soil conservation packages* which can be evaluated by potential adopters. Successful development of these packages will require:

- a selection of the relevant information from existing and emerging data;
- synthesis of these pieces of information into a package; and
- field testing of the packages as noted in 2 above.

Meeting the above needs is likely to require inputs from all participants in the technology transfer process including machinery, chemical and fertilizer manufacturers, researchers and extension personnel. The resources required to develop such packages are likely to be significant. It may be beneficial initially to concentrate on identifying economically sound soil conservation technology packages for those regions where soil degradation is widespread e.g., soil erosion in the Prairies and Southern Ontario; and/or very costly on a per hectare basis, e.g. erodable potato land in New Brunswick.

The extra information identified in this section when linked to existing information should enable the farmer to better answer "yes" or "no" to the two key questions.

Will this soil conservation technology work on my farm?

Will this soil conservation technology pay for itself?

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[1] The authors are staff members of the Development Policy Directorate, Regional Development Branch, Agriculture Canada. Although the paper is presented by the first named, there is no senior author.

[2] Soils with slow internal drainage may respond to no–till after appropriate drainage measures have been taken.

TABLE 1 SOIL DEGRADATION PROBLEMS

| Order of importance[a] | Western Canada[b] | Central and Eastern Canada[c] |
|---|---|---|
| 1 | Water and wind erosion | Water erosion |
| 2 | Organic matter loss | Compaction |
| 3 | Salinity | Wind erosion |
| 4 | Acidification | Acidification |
| 5 | Compaction | |
| 6 | Drainage | |

[a] Based on estimated economic costs
[b] Rennie 1985
[c] Development Consulting House 1985

TABLE 2 AN OVERVIEW OF SELECTED SOIL DEGRADATION REDUCING TECHNOLOGIES

| Soil degradation problem | Possible technologies |
|---|---|
| Erosion | *Mechanical control measures* including contouring; chisel plowing; various types of reduced tillage; terracing and drainage. |
| | *Vegetative control measures* including rotations involving less summerfallow, less row crops and more forages; cover crops; strip cropping; grassed waterways and shelter belts. |
| Organic matter loss | *Mechanical control measures* including reduced tillage operations. |
| | *Non mechanical measures* including incorporation of animal manure; green manuring using cover crops; rotations involving less summerfallow, less row crops and more forages. |
| Salinization | *Mechanical control measure* including surface and subsurface drainage. |
| | *Non mechanical measures* including deep rooted perennial crops; rotations involving less summerfallow; effective snow management practices and use of salt tolerant crops. |
| Compaction | Reduced tillage operations, rotations involving less row crops; better timing of machinery operations; use of smaller equipment; aerial spraying, wide track tractors, controlled wheel traffic including use of "tramlines", deep plowing. |
| Acidification | Application of lime. |
| Drainage | Land forming, surface drains, subsurface drains. |

**TABLE 3 MAJOR INFORMATION SOURCES RELEVANT TO AGRICULTURAL SOIL AND WATER CONSERVATION**

| Class | Examples | Features |
|---|---|---|
| International Agricultural Databases | . *AGRIS* (FAO's International information System for the Agricultural Sciences and Technology) | . emphasis on applied research<br>. broad subject and geographic coverage |
| | . *CAB ABSTRACTS* (Commonwealth Agricultural Bureaux) | . excellent abstracts of both theoretical and applied research |
| | . *AGRICOLA* (USDA/National Agricultural Library's Agricultural On–Line Access database) | |
| | . *CARIS* (FAO's Current Agricultural Research Information System | . research projects in or about developing countries |
| | . *ICAR* (Inventory of Current Agricultural Research) | . Canadian research projects |
| | . *AGREP* (Commission of the European Communities' Research Projects database) | . European research projects |
| Other databases | . *CTIC* (Conservation Tillage Information Center) | . very specialized |
| | . *WATDOC* (Environment Canada's Water Resources Document Reference Centre database) | . excellent Canadian coverage of literature on water erosion and pollution |
| | . *CGIS* (Canada Geographic Information System) | . thematic map data |
| | . Landsat Imagery Library | . remote sensing data |
| | . *CANSIS* (Canada Soil Information System) | . data related to soil science and natural resource studies |
| | . *SOIL STAFF* (USDA/SCS) | . U.S. soil survey data |
| Other sources | . Ecological Abstracts | . applied agricultural ecology |
| | . Agricultural Engineering | . includes policies & programs |
| | . Journal of Soil and Water Conservation | |

## TABLE 4 CANADIAN REFERENCES ON SELECTED SUBJECTS IN FAO'S AGRIS DATABASE ON JULY 30, 1985[a,b]

| Subjects Searched | Document references A World | B Canada | (B/A) % |
|---|---|---|---|
| Code F26 – Soil Resources and Management | 2 275 | 17 | 0.75 |
| Code F27 – Soil Cultivation and Cropping Systems | 16 059 | 178 | 1.11 |
| Code F28 – Soil Erosion and Reclamation | 6 720 | 63 | 0.94 |
| Code P10 – Water Resources and Management | 16 851 | 304 | 1.8 |
| Code P12 – Drainage and Irrigation | 13 512 | 82 | 0.60 |
| Code P20 – Land Resources | 6 694 | 84 | 1.25 |
| Keyword: Tillage | 3 926 | 45 | 1.15 |
| Keyword: Soil Degradation | 51 | 1 | 1.96 |
| Keyword: Soil Loss | 231 | 1 | 0.43 |
| All subjects | 1.2 m | 18 525 | 1.54 |

[a] Courtesy of Bev Chataway, Library, IDRC.
[b] Canadian references include these research reporting in or about Canada. They are not necessarily all Canadian source documents.

## TABLE 5 CANADIAN REFERENCES ON SELECTED SUBJECTS IN THE AGRICOLA AND CAB DATABASES ON JULY 30, 1985[a]

| Subjects searched (Actual search strategy not shown) | AGRICOLA 10, 110 A Total | B Canada | B/A % | CAB A Total | B Canada | B/A % |
|---|---|---|---|---|---|---|
| Soil degradation | 938 | 11 | 1.17 | 2 580 | 96 | 3.72 |
| Soil erosion | 6 953 | 92 | 1.32 | 2 676 | 52 | 1.94 |
| Soil loss | 1 338 | 17 | 1.27 | 1 903 | 70 | 3.68 |
| Tillage | 7 935 | 70 | 0.88 | 7 029 | 180 | 2.56 |
| Soil and pollution | 3 558 | 58 | 1.63 | 2 394 | 113 | 4.72 |
| Water resource management | 15 530 | 296 | 1.91 | 384 | 5 | 1.30 |
| All soil and fertilizer topics[b] | – | – | – | 115 942 | 2 211 | 1.92 |
| All soil and water codes | 132 570 | 1 208 | 0.91 | – | – | – |

[a] Courtesy of Library Division, Agriculture Canada
[b] CAB's *Soils and Fertilizers* abstracting journal

## TABLE 6 AGRICULTURE AND SOIL DEGRADATION REFERENCES IN WATDOC'S CANADIAN ENVIRONMENT DATABASE ON AUGUST 15, 1985[a]

| Search strategy | Hits |
|---|---|
| Erosion | 1 644 |
| Tillage or cultivation or plowing or ploughing | 155 |
| Conservation tillage or zero–till or no–till or reduced tillage | 16 |
| Agriculture or farming | 2 007 |
| Soil degradation | 98 |
| (Soil or soils) and Acidification | 60 |
| (Soil or soils) and Salinization | 11 |
| (Sedimentation or non–point source pollution) and Agriculture | 48 |
| (1 or 2 or 3 or 5 or 6 or 7 or 8) and Economics | 253 |

[a] WATDOC–CENV content is well over 90% Canadian, per Ron Gauthier, Personal Communication

## TABLE 7 AN OVERVIEW OF THE POTENTIAL PHYSICAL IMPACTS OF SELECTED SOIL CONSERVATION TECHNOLOGIES[a]

| Erosion control practice | Impact on | | |
|---|---|---|---|
| | Suitable soil types[b] | Soil erosion | Severity of farm adjustment[c] |
| **Mechanical Control** | | | |
| Moldboard plow | Suited to most soils and management conditions | Little control | Low |
| Contouring | Suited to most soils and management conditions | Excellent water erosion and control when used with other tillage operations | Low |
| Chisel plow | Well adapted to partly drained soils. Application possible on other soils (loam, silt loam) | Less water erosion compared with moldboard plough | Moderate |
| Off-set disk | Well adapted to partly drained soils. Application possible on other soils (loam, silt loam) | Less water erosion compared with moldboard plough | Moderate |
| Ridge till | Well adapted to poorly drained soils (clay type) | Excellent water erosion control | Moderate/ High |
| No-till | Not generally suited to poorly drained soils | Maximum wind and water control | High |
| Drainage | Moderate to poorly drained | Excellent water erosion control | Moderate/ High |
| Terracing | Any (will however depend on the slope gradient and length) | Excellent water erosion control | Moderate/ High |
| **Vegetative Control** | | | |
| Grassed water ways | Any | Moderate to excellent water erosion control | Low/ Moderate |
| Shelter belts | Any | Excellent wind erosion control | Low/ Moderate |
| Crop rotations | Any | Moderate erosion control | High |
| Strip cropping | Any | Moderate erosion control | High |

[a] Assuming typical field operations for each system. The ratings and impact represent generalized rather than specific situations. Local conditions require local interpretations because other factors, such as equipment on hand and farmer's attitudes and abilities will change the ratings. The ratings therefore, should be used only as a starting point for decision making.

[b] Based on Soil textural class.

[c] Based on cost of implementation. degree of management skills involved, etc.

**TABLE 8 PRINCIPAL FACTORS INFLUENCING PROFITABILITY OF SELECTED EROSION LIMITING TECHNOLOGIES**

| Technology | Principal Factors |
|---|---|
| **Western Canada** | |
| – reducing summerfallow | – soil type<br>– soil moisture levels<br>– yield level on stubble<br>– extra crop costs<br>– market conditions<br>– increased risk |
| – growing winter cereals | – winter hardy varieties<br>– market conditions |
| – minimum and zero tillage systems | – yield response variability<br>– extra costs especially pesticides, fertilizers and machinery<br>– weed control<br>– trash management<br>– variable profitability |
| – incorporation of legume into rotation | – cost of legume seed<br>– market for legume |
| **Central and Eastern Canada** | |
| – drainage | – ability to switch to higher value crops<br>– yield response from existing crops |
| – conservation tillage systems (e.g., zero and ridge tillage) | – yield changes<br>– soil type<br>– equipment availability and cost |
| – crop rotations | – management requirements<br>– yield changes associated with crop rotations<br>– lack of livestock enterprise or market<br>– machinery complement |

## TABLE 9 ESTIMATED[a] SHORT RUN ECONOMIC RETURNS AND SOIL LOSS LEVELS FOR VARIOUS SOIL CONSERVATION TECHNOLOGIES, SANDY LOAM SOIL 9% SLOPE, S.W. ONTARIO

| Rotation–Tillage System | Management practice | | Soil loss levels for slope lengths | | | |
|---|---|---|---|---|---|---|
| | Vertical | Contour | 18.2 m | 30.4 m | 60.8 m | Net profit |
| | | | | (t/ha) | | ($/hectare) |
| **Base System** | | | | | | |
| CC – moldboard plough | 1 | 0 | 25 | 32 | 45 | 229 |
| **Tillage Changes** | | | | | | |
| CC – ridge till | 1 | 0 | 7 | 9 | 12 | 241 |
| CC – fallchisel | 1 | 0 | 7 | 9 | 12 | 236 |
| CC – ridge till | 0 | 1 | 4 | 5 | 12 | 217 |
| CC – offset disk | 1 | 0 | 7 | 9 | 12 | 212 |
| CC – fall chisel | 0 | 1 | 4 | 5 | 12 | 211 |
| CC – zero till | 1 | 0 | 8 | 11 | 15 | 210 |
| CC – moldboard plough | 0 | 1 | 15 | 19 | 45 | 204 |
| **Rotation–Tillage Changes** | | | | | | |
| CSBR – zero till | 1 | 0 | 8 | 11 | 15 | 317 |
| CSBR – zero till | 0 | 1 | 5 | 6 | 15 | 292 |
| CBLR – moldboard plough | 1 | 0 | 19 | 25 | 35 | 171 |
| CBLR – moldboard plough | 0 | 1 | 12 | 15 | 39 | 146 |

[a] Estimates are based on economic and physiographic data for Southwestern Ontario and assumptions in the Soilec model developed at the University of Illinois.

CC – continuous grain corn
CSBR – grain corn – soybean rotation
CBLR – grain corn – barley rotation

## TABLE 10 AN OVERVIEW OF THE ECONOMIC FEASIBILITY OF SELECTED SOIL DEGRADATION TECHNOLOGIES FOR USE IN WESTERN CANADA

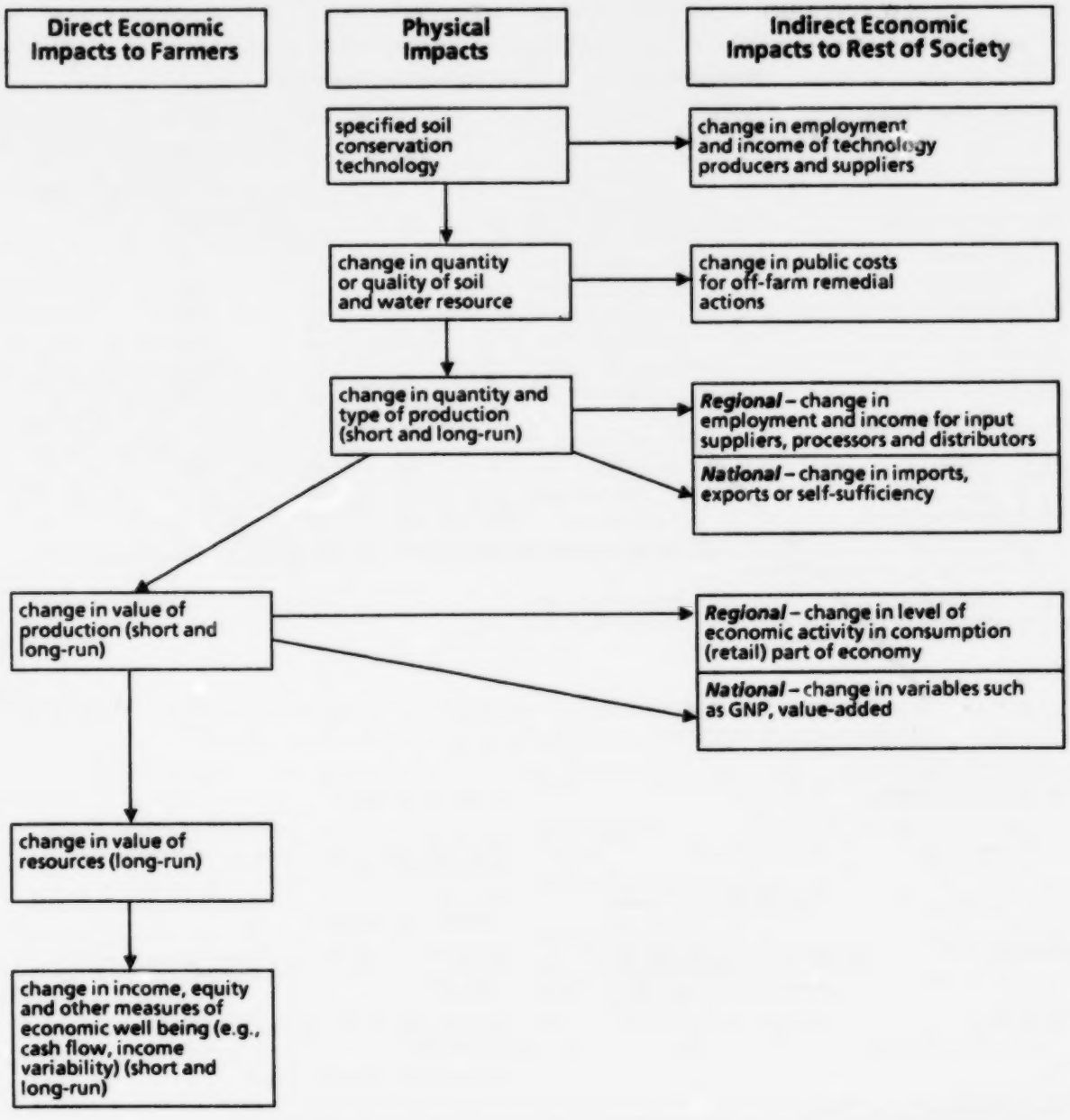
| Soil degradation problem | Technology | Economic feasibility |
|---|---|---|
| Organic matter loss | Longer rotations | Most studies show encouraging economic conclusions. Exception brown soil zone. |
| | Reduced tillage operations | Economic feasibility marginal or highly dependent on yield and input cost changes. |
| Salinity | Mix of Techniques including deep rooted perennial crops and more intensive cropping | Limited number of available studies indicate that control measures are not currently economic. |
| Acidification | Application of lime | Liming appears to be profitable and reliable in many situations |
| | | Payback period under two years. |

*Source*: Anderson M. et al. 1984.

## TABLE 11 AN OVERVIEW OF THE ECONOMIC FEASIBILITY OF SELECTED SOIL DEGRADATION TECHNOLOGIES FOR USE IN CENTRAL AND EASTERN CANADA

| Soil degradation problem | Technology | Economic feasibility |
|---|---|---|
| Compaction | Rotations involving less row crops. | Heavily dependent on availability of a market for the forage or for livestock products |
| Acidification | Addition of lime | Economic feasibility depends on market for forage crops |

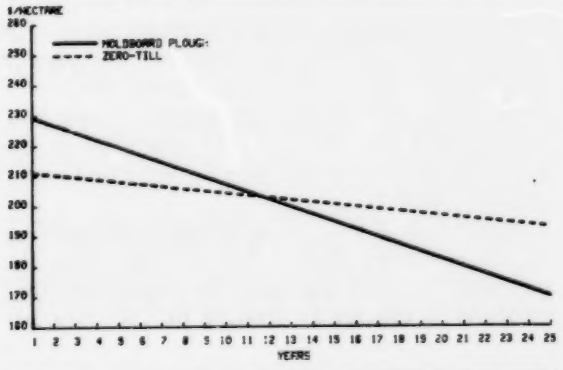
FIGURE 1. POSSIBLE ECONOMIC IMPACTS FROM ADOPTION OF SOIL CONSERVING IMPACTS


Direct Economic Impacts to Farmers
Physical Impacts
Indirect Economic Impacts to Rest of Society
specified soil conservation technology
change in employment and income of technology producers and suppliers
change in quantity or quality of soil and water resource
change in public costs for off-farm remedial actions
change in quantity and type of production (short and long-run)
Regional – change in employment and income for input suppliers, processors and distributors
National – change in imports, exports or self-sufficiency
change in value of production (short and long-run)
Regional – change in level of economic activity in consumption (retail) part of economy
National – change in variables such as GNP, value-added
change in value of resources (long-run)
change in income, equity and other measures of economic well being (e.g., cash flow, income variability) (short and long-run)

## FIGURE 2. INFORMATION REQUIREMENTS FOR ASSESSMENT OF A SPECIFIC SOIL CONSERVATION TECHNOLOGY

| | | Physical Information | | | | | | Economic Information | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Impact area | Soil loss avoided on this farm | Yield | Crop quality | Crop mix | Land available for production | Value of crops produced from farm | Variable costs for farm | Fixed costs for farm | Market value of land of different qualities | Capital requirements |
| *Physical Impact* | | | | | | | | | | |
| Change in quantity of soil and water resource | X | X | X | X | X | X | | | | |
| Change in quality of soil and water resource | | X | X | X | X | X | | | | |
| Quantity and type of production | | X | X | X | X | | | | | |
| short-run | | | | | | | | | | |
| long-run | | | | | | | | | | |
| *Direct Economic Impacts* | | | | | | | | | | |
| Value of production | | | | | | | | | | |
| short-run | | X | X | X | X | X | | | | |
| long-run | | X | X | X | X | X | | | | |
| Long-run value of resources | X | | | | | X | | | X | |
| Economic well being (short-run) | | | | | | | | | | |
| income | | | | | | X | X | X | | |
| cash flow | | | | | | X | X | X | | X |
| income variability | | | | | | X | X | X | | |
| Economic well being (long-run) | | | | | | | | | | |
| income | | | | | | X | X | X | | |
| cash flow | | | | | | X | X | X | | X |
| equity | | | | | | X | X | X | X | |

## FIGURE 3. ESTIMATED RETURNS OF ZERO-TILL AND MOLDBOARD PLOUGH CORN PRODUCTION, SANDY-LOAM, SOIL 9% SLOPE, S.W. ONTARIO, 1983




*Source:* Seecharan, Culver and Murray, 1985

# The role of the agri-business sector in addressing agricultural resource degradation

*R.R. Johnson*

I would like to begin by sharing with you what I think are two important lessons that we have learned in the U.S. These issues were not covered in the presentations by speakers in the plenary sessions. Yet, they are examples where Canada can profit from our slow progress in the U.S. in understanding erosion.

## FATE OF ERODED SOIL

First let's consider the universal soil loss equations that can be used to measure either water or wind erosion. A very important point to me is that these equations do not measure deposition. Yet deposition is a natural part of erosion. There are very few people in the non-scientific community who realize this, and unfortunately, several in the soil science community choose to ignore the issue. The result is that many people grossly over-estimate the net loss of soil due to erosion.

Most have the perception that once soil erodes it enters a stream and is gone forever. Yet we know this is not the case. In recent years there have been enough studies in a number of different watersheds to provide estimates on how much eroded soil actually makes its way into a body of water. To illustrate this I would like to consider two river basins in two different agricultural areas of the U.S. (Table 1).

The total water erosion in the basin of the Des Moines River that runs through the state of Missouri is about 24.9 tonnes per hectare. Yet the quantity of eroded soil that ends up as sediment in any portion of that river basin is 6.7 tonnes per hectare. Thus, 27% of the eroded soil makes its way to any portion of the streams in that river basin. In contrast the other river basins shown in Table 1 have sediment delivery ratios of only six to nine percent, again showing that only a small portion of water-eroded soil actually reaches a body of water. In Canada the fate of water-eroded soil seems to be similar. Coote (1983) estimates that the delivery of eroded soil to streams in Manitoba and Saskatchewan is less than five percent.

The amount of wind-eroded soil actually "lost" from an area has not been quantified, but again it is obvious that a great deal of soil "loss" measured by wind erosion equations is being redeposited on the agricultural land itself. So, one of the key points that I would like to leave with you is that eroded soil is not lost, it has been moved. Introductory soils textbooks define soil erosion as detachment and movement of soil. The word "loss" is not included, yet it remains an unfortunate part of the vocabulary of many "experts" in erosion.

What then is the fate of eroded soil that does not move to streams or reservoirs? Unfortunately precise estimates are not available. A 1982 U.S. Office of Technology Report was only able to state that "much of the soil moved by water remains in the same field, but farther down the slope". Some researchers are beginning to use fallout cesium-137 as a tracer to quantify the fate of eroded soil. McHenry and Bubenzer (1985) used this technique to study an 1100 hectare Wisconsin watershed devoted to intensive dairy agriculture. They found considerable soil movement within fields, but found that between 1974 and 1980 cultivated areas actually gained soil, probably as a result of accretions from erosion and soil transport from higher lying fields. Such studies illustrate the paucity of understanding gained from universal soil loss equation estimates of erosion.

## SITE SPECIFIC NATURE OF EROSION

The universal soil loss equations have been used to conduct inventories of erosion on all non federal lands in the U.S. in 1977 and again in 1982. A tolerable rate of erosion on most U.S. soils is considered to be about five tons/acre. This suggests that below five tons/acre excessive erosion is not occurring and long-term productivity should be maintained. Using this concept Ogg and Miller (1981) partitioned the U.S. cultivated cropland base for wind and water erosion (Table 2).

About 60% of the U.S. cropland is not eroding at an excessive rate. Yet if you read the newspapers, often you gain the impression that cropland is commonly eroding at 100 tons per

acre. Erosion above 100 tons/acre does occur, but it occurs on about 0.5% of the cropland. A key point is that this 0.5% of the cropland accounts for 15% of excessive erosion. Erosion above 20 tons per acre occurs on 9% of the U.S. cropland, but accounts for 70% of the excessive erosion.

Thus, an important lesson from U.S. inventories is that a majority of erosion occurs on a small percentage of the cropland. Perhaps of greater importance in developing control strategies is to realize that erosion differs not only by regions but also by field, and by location within the field. This same situation likely exists in Canada.

## IMPORTANCE OF SURFACE RESIDUE TO MACHINE DESIGN

One of the most effective ways to reduce soil erosion is to maintain crop residue on the soil surface. I like the little sticker that I have seen in Canada that states "Keep your Stubble Up". I think it's nifty and gets across a very important concept. Residue effectively reduces erosion by intercepting the energy of raindrops and wind. Research on several different soils has shown that if just 20 to 30% surface cover is maintained through planting time, erosion rates are reduced by 50% or more (Dickey, et al, 1984).

Handling and maintaining surface residue have been prime objectives in the design of machines for erosion control. Machine systems used for erosion control are commonly referred to as conservation tillage because they produce a rough residue–covered soil surface. The extreme form of conservation tillage is where no tillage is used other than that necessary to place the seed in the soil. Less extreme forms of conservation tillage are commonly called reduced tillage and involve full width tillage that is done in such a way that residue remains on the soil surface at planting time.

## MACHINES FOR CONSERVATION TILLAGE

Effective conservation tillage begins with uniform residue distribution behind the combine. Straw choppers are more effective in spreading residue than are straw spreaders. If headers wider than six meters are used, extended vanes should be used on the straw chopper to assist in providing straw spreading. Chaff spreaders are also available for those who desire improved spreading of chaff.

After harvest the next residue management consideration comes in electing what, if any, tillage operations will be used. Values in Table 3 are typically used by several universities to quantify the amount of residue remaining after a single pass of a tillage tool. Tillage tools are available to either incorporate most or none of the residue. If I were to criticize Table 3 in any way, it would be because the ranges given are much too small. For instance, moldboard plows are currently available that can be manually or hydraulically adjusted to vary width of cut from 36 to 61 cm per bottom. When operated at narrow widths, these plows can leave up to 25% residue cover in corn stubble, but will incorporate most residue if adjusted to the widest cut (Johnson, 1982).

Chisel plows and disk–chisels are one of the most versatile class of machines for conservation tillage, and they too are being continually modified. Some companies currently market over 30 different sweeps, shovels or spikes for use on chisel plows (Johnson, 1982). Sweeps tend to incorporate small amounts of residue while spikes and twisted shovels tend to incorporate intermediate and large amounts of residue, respectively. Among the sweeps, low crown sweeps incorporate little residue and leave the surface relatively smooth while medium and high crown sweeps incorporate increased amounts of residue and leave increased surface roughness. Shank spacings and patterns have been modified to accommodate increased amounts of residue. Several manufacturers also offer shanks with differing capabilities to operate deeper or in rocky conditions. A number of different companies marketing chisel plows now offer disc or coulter gangs out in front. This attachment incorporates more residue but allows the machine to operate in fields that have had high crop yields.

An important point that I have been attempting to make is that in conservation tillage, how a machine is equipped and operated is often as important as the choice of the particular machine. This issue is one that many of our state legislators in the U.S. have failed to recognize. They have often attempted to define conservation tillage based on particular machines, when in fact any machine can be misused if a farmer so desires. Conversely, most machines — even moldboard plows — can be used in a soil conserving manner if so desired.

## PLANTING EQUIPMENT

Conservation tillage has caused the introduction of several new planting devices with a wider variety of options to meet the diverse needs of the marketplace. Row widths less than 30 cm are generally seeded with some type of grain drill. Intermediate row widths (30 to 70 cm) can be seeded with either drills or row crop planters. Row widths greater than 70 cm are almost always seeded with row crop planters. Again proper choice of attachments is crucial to successful operation of these machines.

No–till seedbeds often have an abundant quantity of surface residue and are firmer than reduced tillage seedbeds. Machines differ in their capacity to plant in the wide range of no–till seedbeds. In general, row crop planters designed to plant in row widths wider than 30 cm have the capability of no–till planting in a wider range of seedbeds than grain drills designed to plant in row widths of 15 to 25 cm. Most planters capable of operating under no–till conditions use some type of coulter to open the soil for the seeding device. Each coulter requires several hundred kg of down force to guarantee penetration in dry, firm seedbeds. For example, several no–till planters supply 200 to 300 kg per row unit, whereas, most drills supply 100 to 200 kg per row unit. However, at least one manufacturer offers a drill that supplies up to 500 kg per row unit. Heavy–duty drills with close row spacings are available, but require more planting units and weight — both requirements that increase machine cost. A second method to open a seed furrow is to use powered tillage blades, which also increases machine cost. Thus heavy–duty drills capable of no–till planting under adverse conditions are expensive per unit of width.

A number of lighter duty drills are also available with coulters. These machines have limited ability to no–till plant, but are effective in fields where some full–width tillage has been conducted. In looser soils or fields where irrigation can be used to moisten the topsoil, these machines can effectively serve as no–till planters. Several row crop planters capable of no–till planting in row widths of 36 to 50 cm have recently been introduced. Compared to no–till drills, these machines can often successfully operate in adverse seedbeds at a lower cost per unit width.

A new concept in North America for conservation tillage planting of small grains is the use of air seeders and air drills. These machines use a single central meter and seed tank. After metering, the seed is pneumatically delivered through tubes to each opener. Machines are commonly eight to ten meters or wider. Air seeders usually use either a field cultivator or chisel plow frame and deliver the seed behind the field cultivator or chisel sweep. Hauck and Fanning (1984) state that the major advantages of air seeders are high rates or productivity and ease of transport while the major limitations have been lack of uniform depth control and seed firming capabilities. To overcome these limitations, air drills have been introduced. In contrast to air seeders, air drills use either a disk or hoe opener in combination with a seed firming device. Since many of the air seeders and drills are on chisel plow frames, the planting units are widely spread and have the capability of handling larger quantities of surface residue. Air seeders and drills often have the capability of applying dry fertilizer with the seed. Some air seeders are used in a separate operation to apply fertilizer in a deep band 10 to 15 cm below the soil surface.

## ROW CROP CULTIVATION AND CHEMICAL APPLICATION

Cultivation remains an effective low–cost method of weed control for row crops. In addition, row crop cultivation has increased crop yields on several soils, even when weeds are controlled with herbicides (Johnson, 1985). Cultivators are available to operate in large amounts of surface residue, including fields that were no–till planted. Cultivators used for reduced tillage situations generally have more clearance between sweeps and use a shank that requires more force to cause tripping. No–till and ridge–till cultivators typically have a lead coulter followed by a single heavy–duty shovel. Disk hillers may be used on either reduced or no–till cultivators. As farmers have developed increased interest in reducing trips across the field and saving costs, they have expressed increased interest in using cultivators for additional operations, such as banding post emergence herbicides over the row and applying nitrogen fertilizers.

Another very integral part of conservation tillage is the need for chemicals. Chemical application is an integral portion of several of the tillage and planting machines that are available on the market.

Some herbicides must be soil incorporated and others tend to provide more consistent weed control if incorporated. Thompson, et al (1981) have provided an extensive review of the incorporation capabilities of several different types of tillage tools. Several machines can effectively incorporate herbicides in the 20 to 35% surface residue associated with conservation tillage. As in residue management, successful herbicide incorporation is often as dependent on how the machine is equipped and operated as on the general type of implement used. Several implement companies offer spray equipment as a part of the tillage system. for example, spray tanks and nozzle systems can be purchased as a component or an auxiliary attachment to the tillage implement. Sufficient fore–aft spacing is also being provided within some multi–component tillage tools to allow alternate locations for spray nozzles. In fields with uneven soil surfaces, it may be desirable to locate nozzles after a section of ground engaging tools have leveled the soil surface. In level field surfaces, optimum nozzle location is generally in front of the machine where all ground–engaging tools can be used for chemical mixing.

## SUMMARY

Several speakers in the plenary session stressed the site–specific nature of optimum tillage practices. In addition, I have stressed that much of eroded soil remains in the field and have stressed the site specific nature of soil erosion. In considering these issues it is important that policy planners describe results *desired rather than the methods to obtain the results.* The farmer is an extremely creative person. Tell him the results that need to be accomplished, and let him use his creativity to come up with a solution. Secondly, please remember than in conservation tillage the way a machine is equipped and operated is often as important as the particular machine used. Thirdly, from the farm equipment industry standpoint, equipment should not be a major limitation in the adoption of conservation tillage. Improvements can and will be made. But to those wishing to practice conservation tillage a large number of equipment alternatives currently exist.

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TABLE 1 QUANTITY OF ERODED SOIL THAT ACTUALLY MAKES ITS WAY TO BECOME SEDIMENT IN TWO RIVER BASINS IN THE STATES OF MISSOURI AND OHIO

| River Basin | Water erosion | Sediment yield | Sediment delivery ratio |
|---|---|---|---|
| | t/ha | | – % – |
| **Missouri**[a] | | | |
| Des Moines River | 24.9 | 6.7 | 27 |
| Cache River | 14.6 | 0.9 | 6 |
| **Ohio**[b] | | | |
| Maumee River | 6.8 | 0.6 | 9 |
| Sandusky River | 8.2 | 0.7 | 8 |

[a] C.L. Anderson, 1980.
[b] D.B. Baker, 1985.

TABLE 2 WATER AND WIND EROSION FROM U.S. CROPLAND CULTIVATED IN 1977 (0GG & MILLER, 1981)

| Soil Erosion | % of Cropland | % of Excess Erosion |
|---|---|---|
| –t/acre– | | |
| 0–5 | 60.2 | 0 |
| 5–10 | 19.9 | 8 |
| 10–20 | 11.3 | 22 |
| 20–50 | 6.8 | 37 |
| 50–100 | 1.4 | 18 |
| 100+ | 0.5 | 15 |

TABLE 3 RESIDUE REMAINING AFTER A SINGLE PASS OF A TILLAGE MACHINE. THESE VALUES HAVE BEEN COMPILED FROM SEVERAL EXTENSION PUBLICATIONS PUBLISHED BY U.S. UNIVERSITIES

| Implement | Residue remaining |
|---|---|
| Moldboard Plow | 0 – 5 % |
| Heavy Disk | 25 – 50 % |
| Finishing Disk | 40 – 60 % |
| Chisel Plow | 40 – 80 % |
| Field Cultivator | 75 – 80 % |
| V–Plow | 85 – 90 % |
| Rod Weeder | 90 – 95 % |

# Soil degradation

*L. Bishop*

I have been asked to give a perspective on Soil Degradation in New Brunswick. The farm that I am involved in is located in the Upper St. John River Valley, know as New Brunswick's potato belt (Figure 1).

Our area has been recognized as one of the most seriously hit areas with Soil Erosion and Degradation in the Maritime Provinces.

## HOW DID FARMERS GET INTO SEVERE DEGRADATION PROBLEMS . . .

In the early 1940s technology got its first real start on the farm. Horses were put in the barn and replaced by tractors and all kinds of new "fangled" machinery. Suddenly farmers could plant and harvest more land each season. Inputs were relatively low in price, so more and more land went into production. In the late 1940s farmers had to say good–bye to the old way of diversification and low input costs and hello to more modern technology. It is interesting to note that they said good–bye to most of the farming practices that we today are looking at with such optimism.

They, at that time, had to welcome new costs of all types: pesticides, fertilizers, fuels, labor, machinery and the list goes on. Prices for crops tended to be on the low side so by increasing the yields and the amount planted profits would be larger. "Economy of Scale" became the password.

We could label the 1950s as the "Sod turning Ceremony" officially commemorating Soil and Water Degradation. Through the 1950s and 60s with increased mechanization came specialization and monoculture. We started to grow only one type of cash crop that succeeded to totally destroy and resemblance to the old balanced ecosystem.

Each farm now became larger by removing barriers among fields to accommodate larger equipment. This larger equipment in turn increased the potential for soil erosion to a factor of three and 1/2 times the accepted tolerable rate or from 4 t/acre to 13.5 t/acre in the Victoria County area.

An older knowledgeable farmer that I talk with does not relate to "we" as farmers anymore, instead he calls us "soil miners". Five years ago I thought he was wrong but today I have to admit he was correct.

I do not feel I need to dwell too long on how we got into a severe degradation problem. We have it and have to deal with it! As I once before stated at a "Land Management Seminar" we had in our area, "As Farmers the cause cannot be put on our shoulders, however the final solution does lie with us."

Farmers now in general, are struggling to survive financially and it is going to be very hard to convince them anything about conservation and degradation.

## STEPS WE AS FARMERS HAVE TO TAKE TO ALLEVIATE THE PROBLEM ...

### Education

Before anything is done, farmers and the general public must be made aware of the current soil and water degradation problem and how to alleviate it.

In the United States it is estimated by the Soil Conservation Society of America that a train load of topsoil 276 miles long is lost every day. The people of Canada have tackled and helped many other problems such as polluted rivers and lakes, littered highways, polluted air and so on. We, as a nation, can tackle this problem also.

### Farm revenue

Producers must receive adequate and fair revenue for a quality product based on a sound marketing system.

The current marketing system of farm gate products leaves absolutely no "Fiscal rewards" which could be put toward the problem of soil and water degradation.

For instance, potatoes are selling in Fredericton and Saint John at a price of around $13.00/barrel. Distance is 120 to 200 miles respectively. The farm gate price was $3.00/barrel.

I view this whole problem as a large solid chain with two links that are in a very weak state. One link is price and the other degradation. Both must be corrected or the whole chain is useless.

Every basic necessity of life, be it power, gas, fuel, repairs, has gone up in price except for food at farm gates. The existing "Cheap Food Policy" has got to be settled very soon.

## Incentives from the government level

In this area the governments must take a hard look at their policies both Federal and Provincial.

## Low interest loans for long terms

For most farmers the high interest rates of the 80s have managed to destroy optimism in future planning.

Why? Conservation work requires at least ten years to complete in most cases. I know it is hard for a government to make such a long-term commitment but short-term plans plainly have not worked.

At this point, I would like to re-emphasise the need for a fair return for our products, at the farm gate. Farmers *are* responsible soil stewarts and turning money obtained as profits back into the soil is preferable to a series of government incentive programs to pay for soil conservation.

## Technical services

Trained and experienced technical help is greatly needed to assist farmers with conservation decisions. A one-to-one service to the farmer is very necessary. This must include proper land use data collection, planning surveys, selecting basic conservation practices, and design of Soil Conservation Systems adapted to the farm economic situation.

## A land banking and zoning policy

This should be developed nation wide, Land Preservation and Conservation Policy, to help alleviate the disappearance of prime farmland from problems such as urban sprawl, highways, and erosion. We have a very small arable land base to begin with and unless we manage it properly we will lose it.

A national or group forum in which selected farmers can meet on a yearly basis to discuss problems and procedures with key federal and provincial personnel on conservation programs and strategies in order to maintain a viable program.

We may have to look to other groups like the Soil Conservation Society of American, Soil Conservation Services and their conservation districts to see how they are handling this problem and then decide on a "Made in Canada" solution.

Enhance appropriate research and technology transfer in soil and water conservation:

- Practical research on the "farm" level, example, research on crop productivity on various soil management systems.
- Demonstration and Evaluation of Conservation Practices such as Conservation Tillage, cover crops, etc.
- Evaluate the economic feasibility of various conservation methods applied on the farm and methods to restore the productivity of our eroded soils.

## The preservation of family farms

This type of farm unit has and always will be the most efficient type of farming enterprise. If the low prices of recent years are allowed to continue, the family farm, as we know it, will not be able to survive. Production will be taken over by large corporate farms that have more control over the price of their inputs and have substantial control over the marketing of the final product. Once food production is in their hands the consuming public will have to pay a fair price for products. It is unfortunate to think that we may have to sacrifice the family farm unit in order to receive fair prices.

The family farm preservation concept goes hand-in-hand with Soil Conservation because it will motivate more land owners to pass on to the next generation (from father to sons) a better land use stewardship.

Senator Sparrow, in a recent speech given at Acadia University, stated that as a result of the findings of the Senate Committee on Agriculture, Fisheries and Forestry that he felt we have three alternatives:

- start paying a fair return for farm produce at the farm gate,
- pay direct grants to farmers to do soil conservation work,
- within a few years, import the bulk of our food requirements.

Ladies and Gentlemen, I would like to point out that Soil Degradation is a world-wide problem. All countries of the world are affected. In some areas of the United States, land that originally had 3 feet of top soil is now eroded to 60% bedrock. If we are planning to use Senator Sparrow's third suggestion as a means of putting food on our tables, we are fooling ourselves.

It it my hope that common sense will prevail and that Canadians will never have to go hungry.

FIGURE 1 MARITIME PROVINCES

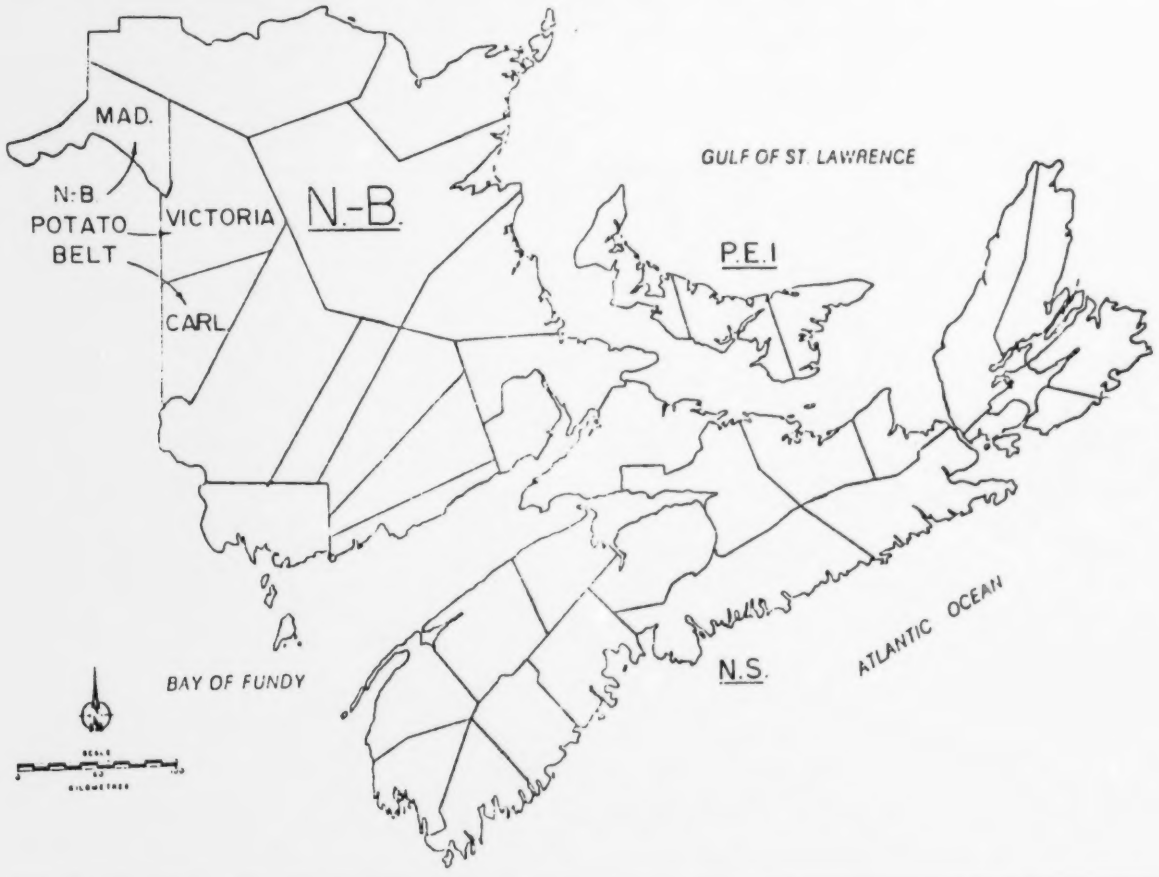
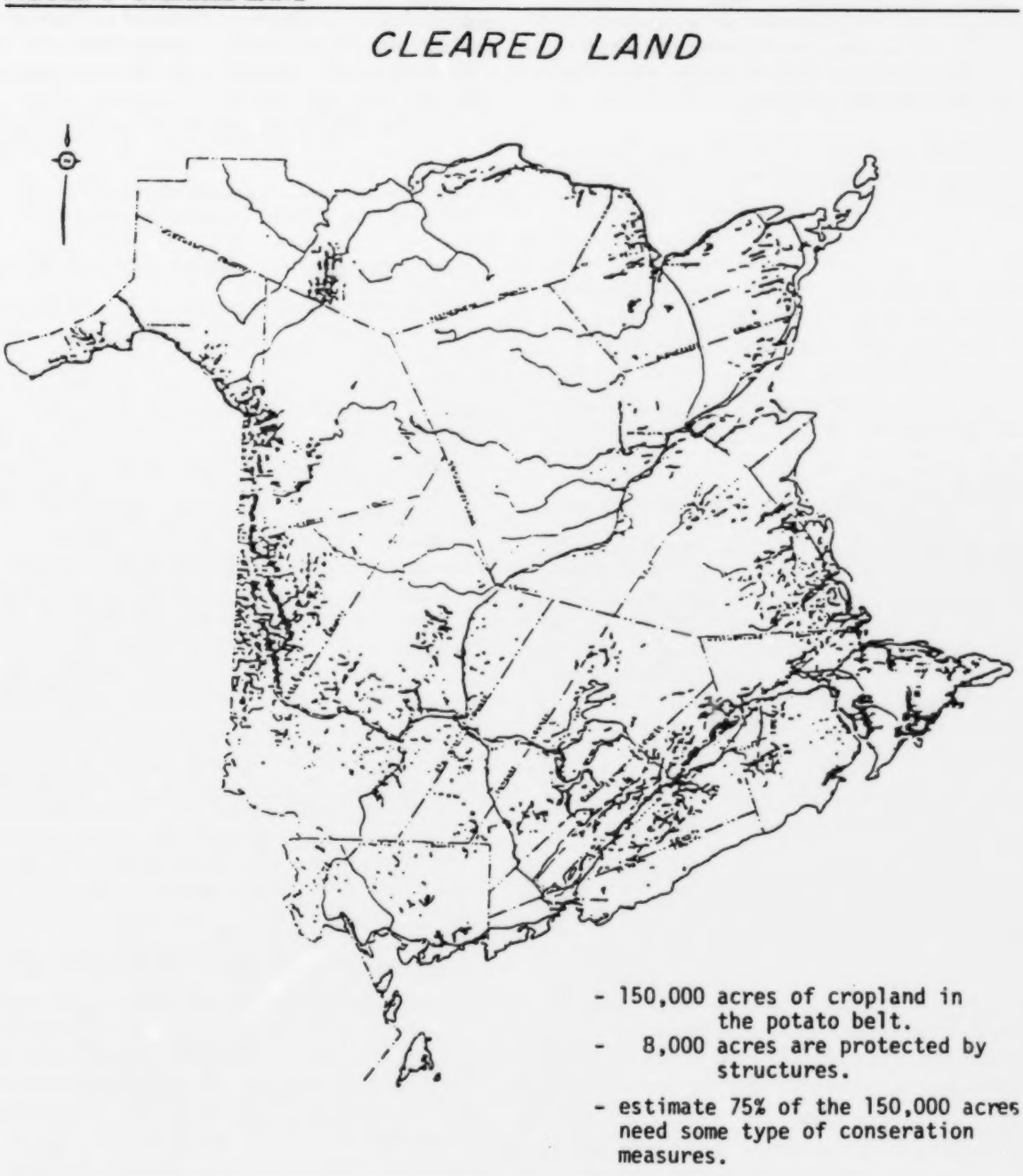
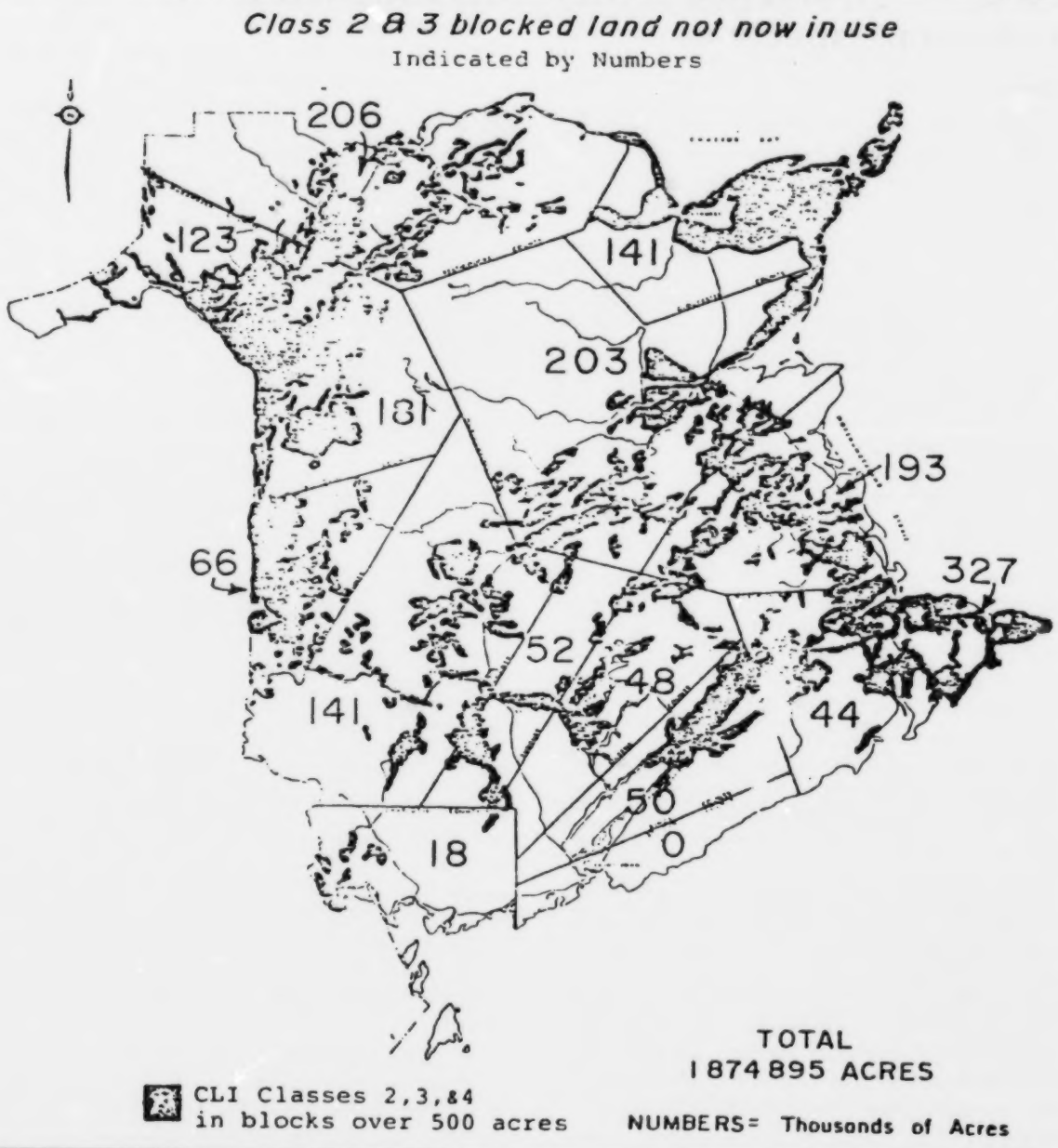


**FIGURE 2 CLEARED LAND**


CLEARED LAND
- 150,000 acres of cropland in the potato belt.
- 8,000 acres are protected by structures.
- estimate 75% of the 150,000 acres need some type of conseration measures.

*Source:* Maritime Resource Management Service

**FIGURE 3 POTENTIAL ADDITIONAL AGRICULTURAL LAND BY COUNTY**




*Sources:* Canada Land Inventory and 1981 Census

# The situation and needs for conservation farming – producer perspectives

*G. Gras*

For years and years, we lived in the tranquil comfort of a seemingly never-ending spiral of progress and prosperity. Our societies evolved at a breathtaking clip. Canada was a vast worksite.

This past was also dominated, though, by a lack of awareness and foresight. We constantly clashed with nature, and it was always the last of our concerns. A common saying was: "You can't stop progress. Nature will put things right." We should have known, though, that one day there would be a price to pay.

We are barely waking up to reality. Considerable damage has been caused. In some cases, the damage is irreversible, and in others, it will quickly become irreversible unless serious action is taken.

Soil degradation and water deterioration are two clear examples of the harm that has been done and of what lies in store if no action is taken. Both problems are the concomitants of progress, caused by types of pollution that are poorly understood but that are every bit as harmful as traditional forms of pollution. We have to act now, while there is still time....

I am naturally delighted that this subject has been included on the agenda and has been chosen as one of the major themes of this prestigious conference. It is a great pleasure for me to be here.

Yesterday and this morning, we heard from distinguished experts. The picture they have drawn is rather disturbing. For my part, I would like to take a few minutes to talk to you a little about the situation in Quebec, which is the region I represent. My observations are based on personal farm experience and my work for the UPA. Afterwards, I will briefly outline what I think should be done in the immediate future.

First of all, I will be very frank. Soil degradation and water deterioration are certainly not major concerns of the Quebec farming community, at the present time at least. In fact, the phenomena are widely misunderstood. Even the government seems to have only barely become aware of the problem.

I should mention that the problem is undoubtedly much less serious in Quebec than in other parts of the country. But mentalities are changing. Quebec farmers are increasingly becoming aware of the dangers that exist and of the need to act quickly. Phenomena such as the strange disease currently affecting our sugar maples have helped create this awareness.

To get back to the situation in Quebec, I would say that the problem, though serious, is relatively new. This can be largely explained by the traditional structure of our farms and agriculture rather than by our having an exceptional degree of perception.

Until the early fifties or sixties, Quebec agriculture was dominated by thousands of small farms that were neither specialized nor mechanized to a significant degree. Such farms are ideal structures from an ecological standpoint.

Afterwards, there was a rapid trend toward specialization and concentration of production. But even here, the risks were fairly limited, since most of the specialization was in the area of milk production.

Even though Quebec agriculture is still largely dominated by the dairy industry, other types of production have found favour with farmers in the province. They include integrated soilless production (especially hogs), field crops, and vegetable and horticultural crops. The result has been a degree of local specialization, increased mechanization, the introduction of monoculture, and so on. In short, these developments have made Quebec's land and water resources clearly more vulnerable. The problems are there and they are very real. We must definitely be on our guard.

However, I would not like to imply that we have never had any major problems. For years urbanization and the speculation accompanying it was a very serious problem in Quebec. Urban development went wild, gobbling up large chunks of our best farmland in the St. Lawrence Plain. Substantial acreage was lost, and the problem grew worse from one year to the next. Fortunately, in 1978, legislation was passed protecting Quebec farmland. This has largely corrected the problem. Needless to say, the legislation came just in time and it is still absolutely vital.

The introduction of mechanization combined with a relatively moist climate led to a disturbing soil compaction problem. Although considerable progress has been made in this area, thanks mainly to subsurface drainage, adaptation of machinery, improved crop management, and so on, the problem is still quite serious in Quebec.

The other types of soil degradation (loss of organic matter, erosion by wind and water, chemical contamination, and so on) existed, no doubt, but to a lesser degree. All this could now change quickly because of the new face of Quebec agriculture.

It is somewhat the same story with water. To date, the problems have been fairly localized. Today, though, the dangers of contamination are present everywhere: in manure, fertilizer, pesticides, all kinds of industrial waste, and acid rain. Even groundwater is threatened.

If there are two resources that must be preserved at any cost, they are definitely the soil and water. Both are absolutely vital, since they are the basis of our agri-food system.

For a long time it was believed that these resources were particularly plentiful in the country and that since they were renewable they could not be exhausted. We now know that this is false. Not only are these resources relatively limited, but they are also vulnerable and easily destructible. If nothing is done, we face certain catastrophe very shortly down the road.

We therefore have to act now, while there is still time. We in Quebec are lucky in a sense. We have an awareness of the problem at the outset. This gives us all the more chance to succeed.

The problem is well-known, its causes have been clearly identified and several excellent remedies are already available. But if we are to succeed, collective action is required, from farmers first of all, but also from society as a whole.

If we want to start at the beginning, I think we should undertake a vast information campaign. This was recommended, moreover, by the Senate Committee investigating the subject last year. Wisdom begins with knowledge. The dangers are not always apparent since they show up only over the medium or long term and are often masked by heavy use of fertilizers.

At the same time as or after the information campaign, a vast education campaign should be launched to outline various methods of correcting or controlling the problem. For example, there are various inexpensive solutions that should be popularized. They include the reintroduction of windbreaks or strip cropping to reduce erosion by wind; reduced tillage and improved crop management to prevent loss of organic matter and soil compaction; planting across slopes, grassing of stream banks, crop rotation, and so on, to reduce erosion by water; and the controlled use of pesticides and fertilizers to prevent contamination of water, and so on. Since all of these problems are inter-related, acting in one area would have a multiplier effect.

It will be up to the farming community to assume a good portion of the work and responsibilities involved. When farmers realize the scope and seriousness of the problem, I am sure that they will agree to do their part. After all, it is their future that is at stake.

Not only the farming community is concerned. For water preservation, in particular, industries will be called upon to co-operate, since they are the source of the most serious forms of pollution (toxic waste, acid rain, and so on).

Governments will also have a role to play, especially in research. They will also disseminate information and provide financial assistance, since it will undoubtedly be required in some cases.

Canadian farmers are currently going through extremely difficult times, and the future is far from bright. Even with the best will in the world, farmers could be prevented from making the necessary improvements because of their poor profit situation. Support measures should therefore be provided as incentive for farmers to improve crop rotation, to practise minimum tillage, to finance remedial work, and so on.

The decisions we make in the coming years will be of crucial importance for the future. Canada must remain an agricultural country. Each of us must work toward that end.

# The situation and needs for conservation farming – producer perspectives

*D. Lobb*

I address you with the benefit of 20 years experience in adopting soil conservation practices. During the past five years I have focused on a limited land structures program and, of more consequence, a reduced tillage/crop production system which in 1985 included 70% of our acreage.

On a broader scale, in Huron County I have participated in the establishment of a grass roots initiated co–operative, soil conservation/technical assistance, and promotional program. This brought together Conservation Authorities, agribusiness, the Ontario Ministry of Agriculture and Food and Farm Organizations and has proved successful in producing unprecedented expansion of soil and water conservation efforts in Ontario.

My observations today are tempered by those of farmer associates whom I have polled concerning "The Situation and Needs for Conservation Farming". I will outline on a prioritized basis those measures with which I have had experience and exposure.

## PRODUCER EXPERIENCE

### General cropping practices

General Cropping Practices which we have used to control soil erosion include:

- reorganizing our fields so that most production practices are conducted across slopes,
- solid seeding beans (as opposed to rows) to provide early and more complete soil protection,
- use of cover crops, and
- rotation of crops.

Although hay crops do reduce erosion to "tolerable" levels, the market is not reliable and crop quality is inconsistent because of unpredictable rainfall. This crop will therefore not be a solution to soil erosion in Central Canada.

Fall seeded cereals, such as wheat, do reduce erosion – but often not to "tolerable" levels. Crop alternatives are limited by market demand and, therefore, we must match existing crops to soil and slope.

This type of common sense crop management does have proven production cost/benefits and will reduce soil erosion in the less critical areas. However, in many situations, soil continues to be lost at unacceptable rates.

### Land drainage

The need for land drainage may be of as much consequence in the humid areas of Canada as organic matter loss and salinization is on the Prairies. Lack of adequate drainage, combined with heavier farm equipment, has contributed to a dramatic increase in soil compaction.[1] Proper drainage reduces surface run–off of water and topsoil[a], particularly under conventional tillage. Where conservation tillage is practised, good drainage is *absolutely essential*. I have experienced yield reductions of 40% (to as high as 90%) where "No–till" corn was tried in areas of inadequate drainage.

Many farmers cannot raise the required first 50% of cost for drainage and land structures projects (grassed waterways, terraces, etc.). In Ontario, Municipality administered Tile Drain Loans (a self supporting program under the Tile Drainage Act) vary in coverage from 50% of project cost to a maximum of 60%. This rate is much too low and is killing the land drainage industry. The ultimate consequence will be restricted general adoption of conservation cropping systems and a continued decline in crop yield potential. Also, in Ontario we have a grant program[2] which may be applied to soil erosion control structures. Individual grants are limited to 50% of cost (maximum $7 500). This program has not been fully patronized.

A program which would be more accessible to farmers, might be to integrate drainage and erosion control structures programs using loans (rather than grants) covering 90% of cost – at minimal interest rates. If the loan interest rates were subsidized by funds otherwise allocated for soil conservation incentives or grants such a program need not increase the "real cost" to government. No matter what conservation/cropping program we adopt adequate land drainage must be in place first.

In consideration of world food production trends it is difficult to justify the drainage of wetlands in excess of five hectares. A precise definition of what is a "wetland" is needed. They should be maintained at no cost to the farm property on which they are situated and public incentives might insure wetland preservation.

## Conservation tillage

Conservation tillage offers farmers one of the few opportunities currently available to reduce production costs. When properly applied, minimized soil degradation will accompany this practice.

Conservation tillage options have not yet been broadly accepted in Ontario because research to date has included agronomic practices which are not acceptable by today's standards. Thus, results have been negative and unfortunately the press has too often blindly focused on this rather than the positive aspects of soil preservation.

My experience has been that chisel plowing has limited application in Eastern Canada due to moist autumn soil conditions, and it has little financial advantage over moldboard plow based system.

Planting row crops on "ridges", (with no primary tillage) is being evaluated with success by a few innovative and persistent farmers. The economics look good. Reduced pesticide use is an attractive part of this system.

A growing number of farmers are working seriously with "No–Till" crop production in Southern Ontario – some on a high percentage of their acres, which testifies to it's economic appeal.

I have undergone intensive evaluation of "No–Till" row crops and cereals for the past five years – with most of my work focused on corn. Through that time we have improved the reliability in crop yield to equal that of the conventional moldboard plow system in most crop situations. Soyabeans, wheat and barley grown "No–Till" are producing average yields similar to conventional till crops, however more work is needed to ensure system reliability. With experience, input costs (fertilizer, herbicides, etc.) have been reduced to levels similar to conventional tillage.

Under current economic conditions, the opportunity for reduced fuel, time and equipment cost will induce broader interest in these systems. Each is conservation effective and reduces the current high loss of organic matter and soil. The best tillage system is always site and operator specific. In each cropping situation there is the potential for some form of conservation tillage to INCREASE net profit.

In most cases the transition to the new tillage/cropping system will necessitate more equipment, not less, until the adoption program is complete. It is therefore essential that some trial–use equipment be made available to interested, and competent, farm operators. It is desirable that the equipment be under supervised use for a learning period of two to three years. In Huron County the majority of farmers involved in such a program have continued their soil conservation work.

NOTE: Conservation planters and tillage equipment are not usually prohibitive in cost, however "No–Till" drills for cereals are the exception – with cost running to twice that of conventional drills. Perhaps different grain seeding concepts are needed for soil conservation work!

## Land structures

Land structures, including berm–drop inlet systems, grassed waterways and a terrace have been constructed to control movement of surface water and topsoil on our farm. However, other than in isolated critical situations they are not a cost effective alternative to agronomic measures. For example, a terrace may be constructed using the Ontario Soil Conservation Grant of 50%. However the remaining 50% would require 10% of the gross income from corn crops for ten years – if we could borrow the money at 10% interest!

These are measures of last resort and, when needed, do require public financial assistance.

## Reforestation

Reforestation has been applied to those of our acres which have potential for low crop profit and unacceptable levels of soil erosion.

Our WINDBREAK system is nearing completion. Ontario research has proven crop yield improvement as a result of windbreak protection. It is difficult however to justify taking land out of production for such purposes.

A limited land retirement program could make these two types of projects justifiable for farmers in the short term, as well as insuring obvious long term benefits to agriculture and society.

Suitable tree species are not always readily available at reasonable cost. I have been on a government source waiting list for as long as three years.

## PRODUCER NEEDS

Producer needs lie in the areas of technical assistance, information, product availability and financial incentives.

### Technical assistance

Good technical assistance is critical to the adoption of soil conservation measures. We simply do not have enough experienced people in Ontario, and the education process will be slow where the focus is on tillage comparisons/ demonstrations, rather than on conservation cropping system development. That concerns me, because an extension worker's enthusiasm is no substitute for experience when advising farmers whose incomes will be at stake!

In Huron County we have benefited from past American and Ontario experience. Over the past four years we have had a very rapid expansion of our soil conservation program – as long as it was treated as a learning program with technical assistance support. In other areas the more institutionalized approach of tillage–demonstrations has been used (some with large farmer cash incentives), and these have produced little in the adoption of conservation cropping practices. Demonstrations are very expensive and simply put farmer expectations too high.

The most effective approach is to target technical assistance to farmers who are interested and have high probability of success, because their success will sell soil conservation practices. Government initiatives only provide a friendly environment for the sale.

### Information

Crop system development "information" must flow quickly through extension people between the farm situation and researchers. In Ontario it is encouraging that bright young people are being attracted to, and, taking their place at both research and extension levels.

Information in the broader sense might most efficiently be handled with a system similar to the Conservation Tillage Information Centre in the United States. This is a co–operative industry and government program.

There are two advantages: industry shares the cost, and industry assumes a front line role in the dissemination of good information. This is important because farmers discuss production concerns far more often with their chemical suppliers, or machinery dealers, or bankers, etc. than with extension workers.

In Canada we need two distinctly different types of conservation cropping information – thus the need for two information centres. One to serve the arid region – the Prairies. This region has 151 700 farms with total cash receipts of $10 172 747 000.[3] A separate centre is needed to serve the more humid regions of Canada. Central Canada (Ontario and Quebec) alone has 129 000 farms (85% of the Prairies numbers) with cash receipts of $8 262 708 000 (82% of the Prairies figures)[3].

Each region situation makes a significant contribution to agricultural production and each has it's own unique degradation problems which require unique solutions[4]. How great the program is may depend on how and why the estimates are arrived at, but certainly the total degradation picture in Ontario is staggering. Nowhere can farmers find a quick or economical solution to replace the damage which has been done.

If we make it a priority to gather and distribute effective regionally–specific information to farmers then we can preserve, and possibly improve, production from our remaining viable croplands.

### Product availability

Difficulty in obtaining required "products" for conservation crop production is currently a limiting factor in the system's progress. Because we are frequently dealing with emerged vegetation, we need specific products such as "Blazer" and "Bronco"[5] which are registered in the United States but not (presently) in Canada – because of limited markets and high registration costs. Also, we need registration of product combinations, where products are now registered separately. For example: 24D + Corn Oil + Atrazine; Linuron + Corn Oil.

Equipment development for conservation tillage purposes is progressing well due to American initiative, although I have not yet seen a planter which did not need some modification to suit local conditions.

Also relative to the issue of products is the matter of import duties on soil conservation materials. For example, an 11% federal duty on plastic drop inlets which are used in waterways and surface water collection areas. The Canadian distributor for these items can find no Canadian manufacturer willing to produce a comparable product. This matter needs review if structural conservation measures are to be attractive.

## Incentives

"Incentives" will be necessary to provide the impetus to move conservation practices from the innovators and researchers to general use. Outright cash incentives are very expensive and have proven ineffective in producing lasting results. Equipment purchase incentives guarantee nothing in terms of successful application of soil conservation measures.

Currently more than 30% of Ontario farmland is rented[6] – a very high percentage of this on an annual basis. Landlord and tenancy guidelines should be established to insure responsible land use, and so that each party clearly understands his responsibilities. Land maintenance incentives should be shared. Rental agreements for a minimum of three years are essential to justify responsible tenant land stewartship.

Land retirement incentives could be a useful tool to justify land taken out of production for windbreaks. It could also apply to reforestation or to seeding to grass permanently of erosion prone areas.

A Farm Credit Corporation loan could be accompanied by a conservation plan and be conditional that this plan be followed. The cost of major works (i.e., terraces, grassed waterways) should be included in the loan.

Property tax incentives are a fair way to reward conservation efforts. For example, in Ontario why should a farmer who silts in, or pollutes, a municipal ditch or stream get the same farmland tax rebate as a good land manager? Cross-compliance might be in the form of preferred rates for crop insurance, stabilization or other government programs. This would be a reasonable approach to resolve the erosion problem and reduce risk costs as new production systems are adapted.

## SUMMARY

In summary, incentives must be attached to the management of land. If government programs create the need to conserve soil productivity, farmers will address the challenge and succeed. Crop production using soil conservation practices will be profitable for both farmers and society.

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1 See Appendix "A" – the most recently available evaluation of Ontario, "Annual Soil Degradation Cost Estimates" – Baldwin et al. 1985.

2 Ontario Soil Conservation and Environmental Protection Assistance Program (OSCEPAP)

3 Agricultural Statistics for Ontario, 1984, Statistics Canada, 1984

4 See Appendix "A" – the most recently available evaluation of Ontario "Annual Soil Degradation Cost Estimates", Baldwin et al.

5 "Blazer", a product of Rohm and Haas. "Bronco", a product of Monsanto.

6 Agricultural Statistics for Ontario, 1984.

TABLE 1 ANNUAL SOIL DEGRADATION COST ESTIMATES FOR THE PROVINCE OF ONTARIO, CANADA[a]

| Degradation Item | | Loss Estimates |
|---|---|---|
| | | (millions of dollars) |
| A. | Compaction | 322.5 |
| B. | Acidification | 14.0 |
| C. | Organic Matter Loss | 122.5 |
| D. | Drainage | 19.4 |
| E. | Erosion | 68.0 |
| F. | Machinery Investment | x |
| | | 546.4 |

[a] It is assumed that there are approximately 9 million acres of arable land.

X plus X where X = 10's of millions of dollars

# Producer experiences and needs concerning soil and water conservation

*D. Connick*

## EXPERIENCES CONCERNING SOIL AND WATER CONSERVATION

When I moved to the farm in 1977 I had a background in production and conservation that I had gained from 12 years of working in the Extension Service of the Manitoba Department of Agriculture. During that 12 years I had become graphically aware that black summerfallow was the single largest contributor to soil erosion and salinity on the prairies.

This experience; coupled with the idea that the best way to improve the soil under dryland farming conditions was to grow the best crop you can every year that you can and to return all the crop residue to the soil, made me decide to try to extend the crop rotation on our farm in Southwest Saskatchewan. I wanted to move from the traditional half–crop, half summerfallow rotation to at least a 2/3 crop and 1/3 summerfallow system.

Summerfallow is that curious practice followed by farmers on the Great Plains of North America whereby they cultivate their fields every other year or so to "rest the land". It is summerfallow that makes those interesting rectangular patterns you see when you fly over the prairies. It allows the organic matter in the soil to break down to provide a supply of nitrogen for the next crop year; it stores some moisture; it controls certain weeds and it leaves the soil unprotected so it can blow away in the prairie winds and wash away in a prairie downpour. (I might add here that in the last few years we have seen a lot more prairie winds than prairie downpours.)

Over time, we moved from a one–half summerfallow rotation towards a 1/3 summerfallow rotation using moderate amounts of nitrogen and enjoying a fair bit of success with our cropping program. As well, we began conservation tillage on our summerfallow and experimented with several special crops.

In the fall of 1981, Dr. Don Rennie and Doug Wilkinson came along with a program called "Farmlab". The plan was to use optimum rates of nitrogen fertilizer, strict weed control, minimum tillage and techniques to trap snow for additional moisture so that a crop could be grown every year. We allocated 80 acres to this program. Forty acres to be cropped every year and 40 acres to be in a half summerfallow rotation. We have enjoyed excellent yields on the continuously cropped "Farmlab" field for four years.

As a result of our "Farmlab" experience we began using higher rates of nitrogen on our other stubble crops and a swather deflector for trapping snow that was developed by Ben Dyck at the Swift Current Research Station. In 1982 and 1983, our stubble crops on the farm actually outyielded our summerfallow crops. We thought we really had a hold of something!

About this same time, many other farmers on the prairies began to do a lot more stubble cropping. Moisture was good, grain was moving and at a pretty good price. The advent of the "deep–bander" for placing nitrogen fertilizer and the message of Dr. Rennie, and other research and extension people who advocated less summerfallow, all contributed to rapid expansion into a more intensive cropping system in Saskatchewan.

We were making progress!

The "Weatherman" dealt us a nasty hand in 1984. Drought across the southern prairies reduced stubble crops in particular, to short, burned up, pitiful plants. The weather was kinder in other parts of the world so grain stocks piled up and prices fell. In the Spring of 1985, many farmers planted stubble fields again. It did prevent soil erosion, moisture was good in the Spring of '85 and grain prices were low so many producers sought to maintain cash flows by planting more acres to grow more bushels.

Well, the old "Weatherman" did it to us again! Frost, drought, grasshoppers and an early snow reduced the southern prairie crop to a fraction of normal while northern farmers harvested the biggest, wettest, poorest quality crop anyone had seen in a good long time.

Where does this leave us heading into 1986? There is a whole new generation of farmers out there that are well educated, concerned about conservation, receptive to new ideas, and in — serious financial trouble.

Many of these farmers have little alternative but to go back to the old ways; to cut input costs drastically, to reduce margins of risk and to

become entrenched into the old cereal grain on summerfallow routine. This practice of mining the soil could be called exploitation during good financial times for farmers. During times such as these, mining the soil cannot be called exploitation — it is called survival.

It is pertinent that soil and water conservation is a part of the Economic Outlook Conference in 1985, because economics will play a large part in whether or not soil conservation is a priority item for prairie farmers in the remainder of this decade.

Economics in the cattle industry has caused cattle numbers to decline sharply in recent years. There just is not much money in raising beef cattle. Low cattle prices along with the drought has pushed beef cattle numbers in Western Canada from a high in the mid-seventies to a population below that of the early sixties. In southwest Saskatchewan, beef cattle dropped by 75 000 head between July 1, 1984 and July 1, 1985. Most of these cattle were raised on marginal land; fragile land that in most cases should be left under grass cover. But cattlemen seeking to improve cash flows sold their cattle and plowed under the grass to raise again. It seemed that was where the dollars were. They were wrong! Drought and falling grain prices have proven that this was not the answer. But the process is irreversible. Most of the range land that has been plowed under for crop production will never be regrassed unless there are dramatic changes in economics and technology. Hundreds of thousands of acres that are vulnerable to serious soil erosion have now been added to our crop lands.

## NEEDS CONCERNING SOIL AND WATER CONSERVATION

I see eight needs for soil and water conservation on the prairies for the remainder of the eighties.

Higher commodity prices would have a positive effect on conservation farming. I know we are talking about international markets here. We are victims of our own success all over the world. But maybe Canadians should be paying more for domestically produced food. Maybe there is too much money being spent on VCR's and second cars and not enough on Canadian food. Maybe there is too much money being spent on television advertising, and preparation, and additives and fancy packaging and not enough on good, wholesome food.

Do we have our spending priorities sorted out right in Canadian households and in the Canadian House of Commons? Are food and research on food production and soil conservation to preserve our land base for future generations being pushed to the back burner in both the kitchens and the conference rooms of our nation?

An alternative to higher commodity prices would be lower input costs for fuel, fertilizer, farm machinery and chemicals. This would lower the margin of risk in a conservation farming system.

Barring these two unlikely scenarios, we should look at improving price stability by improving the Western Grain Stabilization Program or by improving production stability by changes to the Crop Insurance Program. Right now my Crop Insurance coverage encourages me to grow wheat or barley on summerfallow. Crop Insurance provides less coverage for stubble crops even though my production costs are higher. Winter wheat – which is viewed as a conservation crop – has a low rate of Crop Insurance coverage in my area.

Another "conservation need" for the southern prairies is a good nitrogen-fixing annual plowdown crop for soil improvement.

The ideal plowdown crop should be cheap to plant. It must be reliable to establish under dry conditions. It must be moisture efficient so not too much water is used up for subsequent crops. It should be useful for emergency fodder if it is required, and it should compete well with weeds. An N-fixing wheat would be an alternative for soil improvement that needs continuing research.

If we wish to pursue an intensified cropping regime, we need an efficient snow trapping device. This device should be able to be mounted on swathers or on straight-cut headers for combines. It must trap snow effectively, it should not leave much grain behind and it should be cheap to buy.

We need better winter wheat varieties for the southern prairies. The wheat must be drought tolerant, it must have high winter survival, good yield potential and improved quality so that the price differential between Hard Red Spring Wheat and Hard Red Winter Wheat is less (now $3.98 for Hard Red Spring versus $3.57 for Hard Red Winter). We also need Crop Insurance coverage on Winter Wheat that will be in line with coverage on Hard Red Spring Wheats and durum.

We need more work on chemical fallow. A safe, effective, inexpensive chemical for weed control in a chem–fallow program is required. This chemical should have a residual action long enough to last through the fallow season but short enough so as not to affect a subsequent crop.

We need continuing research on effective reliable 0–tillage and reduced tillage seeding implements that are reasonably priced. These implements must place seed accurately in a variety of soil and moisture conditions and they should have capacity to carry large payloads of seed and fertilizer.

We need an ongoing and expanding program of research and field trials on soil and water conservation under prairie conditions. The scope of this research must extend from microbiology to machinery development for conservation tillage. In must include crop research, fertility, markets, economics, machinery and the long term implications of chemical use. This research should be coordinated and priorized with goals defined by a time frame.

We need an intensive program of education and soil conservation – on both the problems we are facing and the known solutions. The program must be directed at both the producer and the consumer, both rural and urban people so that we become a nation that takes pride in preserving our land as a renewable resource for future generations.

To close, I would like to leave you with an analogy. Most provinces in Canada use salt on the roads to melt the ice in the winter time. They use salt because it is cheap and effective. There are other ways to achieve the same end, but it is perceived that the public will not tolerate the extra expense. But the driving public pays – cars rust away; new cars cost more because they must be rust–proofed. So a saving on one end merely results in a larger cost on the other end of the spectrum.

The same is true of agriculture. We produce food and sell it for low prices because it is perceived that the public demands it. But the real cost is great. Because the long–term result of cheap food is soil abuse and degradation – a deferral of the cost to future generations.

If one of the measures of the quality of any society is the ability to put food on the tables of its people, then we are succeeding admirably today – but we may be failing the future dismally.

# Wrap–up conference theme

*D. Knoerr*

One option available to a "wrap–up" speaker is to summarize and clarify the points that the previous speakers have made, and then try to put them together and paint a total picture.

That is not the route I am going to take today. The previous speakers have presented papers that have clearly stated their perspective on the nature of the problem and the types of measures necessary to solve the problems that exist. I lack the expertise to try to add to or refine the points they have made.

What I plan to do is share with you the thoughts and questions that have been going around in my head as I try to understand the issues and put them in their proper perspective.

My purpose is not to underestimate the importance of soil and water conservation. The evidence is that we have major soil quality problems. My interest lies in developing an effective and realistic approach to solving those problems.

If you will permit me some hyperbole and poetic licence, I will take you through my thought processes. It may, at least raise some questions worth consideration.

I was confused during the first session of this conference. I heard Dr. Crosson say that soil erosion on farms is not really that serious. Then I hear Dr. Rennie say just the opposite. He suggested that we had been paying dearly for soil erosion and loss of soil quality. To exaggerate a bit, I was caught between a technological fix and a doomsday scenario.

Dr. Crosson asserted that the agricultural consequences of soil erosion weren't as serious as had been predicted. He identified rapid sedimentation behind dams as the most important soil erosion problem. He suggested that benefit–cost analysis would show that efforts should be concentrated on managing the deposition of sediment.

My reaction was that he might not have realized what the problem was. The dam he referred to was built for a 50 year life. Due to sedimentations, its useful life was going to be reduced to 30 years. If you use benefit–cost analysis you know that at a 10% discount rate, a benefit 28 years from now is worth only 1/16 of its current value. Even at a 7% discount rate, the value 30 years ahead is 1/8 of the current value. When the dam was built it really didn't matter that much if the dam only lasted 30 years.

It certainly is difficult to quantify and rectify problems that are the consequences of activities on thousands of individual farms. It is easier if the real problems lie downstream and can be solved by the application of technology at a limited number sites.

Even though intervening events (including perhaps some remedial action) have caused the worst predictions to be wrong, it does not mean that the problem did not or does not exist. Nor does difficulty in identifying easy solutions justify not making the extra effort necessary to deal with soil conservation problems.

Listening to Dr. Rennie, I thought of some situations I have been in when dealing with resource issues, much like the people who have visions of the end of the world. They predict the date, go up on the mountain top and wait for the end. After a while they get this funny feeling because nothing happens and they then have to live with the consequences. A bit of hyperbole but a serious point.

During the seventies a number of reports presented evidence indicating that the quantity and quality of the land base with agricultural capability was being seriously reduced. The prediction was that the effect of this shrinking resource base coupled with a rapidly growing world population meant that we were headed for a crisis.

I, like a lot of people interested in preserving the agricultural land base, used what I call a doomsday scenario in support of the case we were trying to make. We predicted economic loss and even serious food supply problems unless the correct remedial action was taken quickly.

The risks in this type of approach lies in raising expectations which, in the short run at least, may not happen.

Perhaps what is really happening has been masked by technology, but the current view of the agricultural situation is very different than in the seventies. The current view is that we have an over–capacity to produce food with little change in sight, prices are soft and there is discussion of the need to reduce production.

The same type of problem can arise when we try to put a dollar value on the cost of soil erosion

and quality loss or calculate the benefits to be gained by remedial action.

As a beef producer, I once received a publication describing various things that I could do to improve my productivity; earlier calving, improved breeding, improved pasture, etc. The benefits of each step were added together to show how much I could gain by using good management.

The difficulty was that I know from experience that, even though each step might produce the predicted result by itself, they were overlapping in effect and you couldn't just add the pieces to get the end result. I also knew that there were costs associated with making these improvements that weren't included in the calculation of benefits.

The result was that, even though the advice may have been fairly sound, I lost confidence in the author's opinion because of the errors I found.

I was thinking of this when I heard the illustrations of the cost of poor soil management.

I am not sure, for example, that you would be believed if you told farmers that they could increase their net income by 80% if they managed the soil better. And I suspect that there are a lot of farmers who would not understand if you told them that the cost they were paying for soil degradation is higher than their interest costs, particularly if they happened to be one of our young, indebted farmers.

The graph on fertilizer prices made me uneasy. You can't necessarily charge all the costs of increased fertilizer use to soil degradation. Our productive demands may require increased fertilizer consumption even if the soil is in good health.

The comments Dr. Rennie made concerning soil conservation research are important and should be emphasized.

We have been told during this conference that there are some areas such as salinization where our knowledge is weak. Some solutions may work but prove too costly for farmers to adapt. As we apply the existing technology and information new questions may arise. Only with substantial on-going soil conservation research, can we be confident that we will have the necessary information and tools.

An example of the need for options and the importance of Government's role in agricultural research is in the area of pesticide use.

The use of agricultural chemicals is very important to Canadian farmers, particularly when we consider the competitive pressure from farmers in other countries. However, there is constant pressure on farmers rights to use them. Tools that farmers use are taken from them. Chemicals used in competing countries are not available to Canadian farmers. Established application techniques become unacceptable.

It is important that farmers have the broadest range of options for dealing with disease, insect and weed problems. These options would include cultural alternatives, biological control, integrated pest management and techniques which reduce the quantity of pesticide needed for an effective application.

These options aren't necessarily in the financial interests of the private sector serving agriculture. If Government doesn't play its part, the research job won't be done.

I have one exception to what Dr. Rennie said about research. I don't believe that we can successfully fund soil conservation research by diverting funds from other areas of agricultural research. The other work is needed and if not done will create pressures which will rob soils work in the longer run. If we need more research, we are going to have to find the additional funding to get the job done.

One type of farm land loss hasn't gotten much discussion at this conference. That is the loss of farm land to other uses; urbanization, rural residential use and industrial development.

The problem is not as widely spread as the other soil conservation problems and the acreages we lose annually are relatively small in terms of the total land base, but if you look at the small amount of very high capability land we have and its close proximity to urban areas then you begin to sense that perhaps that side of the question is important too. Think of three of the areas that Rod Bailey identified yesterday; the Lower Fraser Valley, Southern Ontario and at least part of the lowlands along the St. Lawrence River. These are all areas where this is an extremely important issue. I do not see that you can logically expect a farmer to cherish and preserve a resource for future generations when on the other hand he can see a process happening that raises serious questions as to whether that resource will even be around for the next generation.

You cannot expect the farmer to take an approach to that land beyond his own short term personal interests or the ease of exploiting it if you are just going to leave the future of that land to the vagaries of the marketplace without any

intervention to make sure that the land stays in agriculture.

It is useful to note the response of the farming community when legislation is proposed or enacted to prevent the loss of farm land to other uses. Simply put, the farmer's reaction is "if you are going to take away some of my property rights, I want assurances that the Government will take steps to ensure that farming that land is profitable."

If we find that farmers are required to use extraordinary steps (steps beyond their own perceived self interest) to protect soil quality, we may find that we need extraordinary measures to deal with their viability.

Another area of my thought, I would like to share with you, is what I call "trying to swing the dog by the tail". No matter how important soil quality issues are, we are running significant risks if we try to look at all agricultural programs and policies solely through the narrow window of soil conservation.

Some random points to illustrate my thoughts:

It could be very useful to include more forages in crop rotations, but given the nature of markets and the changing technology of livestock production it is hard to imagine where these additional forages could be sold.

It has been stated that some of the recommended approaches would increase productivity and that we should vigorously market that product. However, markets are already seriously strained and prices dangerously low. Significant increases in production could precipitate further price reductions. The cost of bringing those prices up to realistic levels could be beyond the capacity of public treasuries.

It was suggested that we consider property tax incentives to encourage good soil management. In many parts of Canada, the taxes on agricultural land are already modified to reflect the nature of agricultural returns. A further reduction of those taxes may not be that great an incentive or could cause tax collectors to believe that farmers aren't paying their fair share.

Agriculture programs and policy should not negatively affect the way we manage our soils, but there are other important factors that have to be considered before we can safely alter many of our policies and programs.

Although control of land and physical resources lies principally within Provincial powers, I don't think we should underestimate the importance of national policy in this area.

I'm thinking of the Mirabel land fiasco. The conflict between farmers and Federal Fisheries staff, over drainage work, is serious in some parts of Canada. Wildlife enhancement projects can cause agricultural problems. The developments necessary to permit the export of water or power, an area under Federal jurisdiction could damage agriculture's interests.

My closing thought is that the real case for soil conservation is just good common sense. The need has been there since the first man started cultivating land. If you are going to produce your food from the soil, it is only common sense that you have to maintain the health of the soil or we won't get the food produced. The nature of our agricultural production is varied and complex. There are no neat, simple solutions that will solve all our problems. Nor is there any point where we will be able to conclude that we have solved soil management problems forever. We need to build a recognition of the importance of soil conservation into our basic approach to Canadian agriculture on an on-going, permanent basis.

# PLENARY SESSION III

# CLOSING REMARKS

*Honorable John Wise*

Well, you've heard the news. I'm sure every one of us would have preferred a more positive outlook for the coming year.

Many farmers are facing very difficult financial circumstances, and based on the forecasts we've heard at this conference, the situation is not going to turn around overnight.

First of all, we have to realize that each farmer's situation is unique. In the final analysis, each farmer is responsible for making his or her own management decisions. The responsibility of governments is to do what we can to support producers as a group, and to ensure that the structure of the industry is as strong as possible.

Fulfilling this responsibility requires a firm resolve by both levels of government and by producers to co–operate in finding realistic solutions.

This is particularly true at a time when governments have limited financial resources, yet we face demands for spending those resources which seem almost limitless.

We also have to realize that our agricultural outlook is extraordinarily dependent on the international marketplace, and on non–farm factors such as interest and exchange rates. That's why an overall improvement in Canada's economy, and in the international economy, is extremely important to Canada's farmers.

During the first year of our mandate, the Government made a responsible decision to bring the national debt under control, because we recognized that it was crippling our economy.

This has meant making some very difficult decisions over the past year. But we've begun to see the results.

The inflation rate now is down to about 4% a year, and we expect the trend to continue. Our Gross National Product grew at a rate of 4% in the second quarter, which is a performance that outpaced the U.S. economy.

Business confidence has grown, and consumer confidence has taken an upward swing.

The unemployment rate has declined overall, and 416 000 new jobs have been created.

Interest rates set by the chartered banks have dropped to their lowest level since 1978.

A healthy economy benefits all Canadians. Declining interest rates are particularly significant for the farming community, since a percentage point drop represents an annual saving to Canadian farmers of $120 million.

When resources are limited, but the challenges are great, it's absolutely essential to co–ordinate and target all of our efforts. We can't afford overlap. We must be innovative with our programs, and with our resources.

Agriculture is a shared responsibility between the federal and provincial governments. During these difficult times, Canadian farmers should rightfully expect both levels of government to work in co–operation.

We took a step in the right direction at the First Ministers' Conference in Halifax two weeks ago by achieving agreement at the highest level to work together on four key agricultural issues.

The first is trade. We want to co–ordinate federal and provincial efforts in international marketing.

The second area is farm finance. We see an urgent need to address the cost–price squeeze in farming; the special financial, credit and tax needs of the sector; and the need for comprehensive insurance and disaster relief programs that respond to recurring natural hazards.

We'll also find ways to work together in order to maintain and rebuild Canada's soil and water resources.

And finally, we'll discuss agricultural development. That includes improving the transfer of research and technology in order to increase Canada's competitiveness in food production, processing, distribution and in the retail food sector.

I hope to meet with the provincial Ministers of Agriculture in January to begin work on these four key issues. We're to report back to the First Ministers within six months.

I believe the Government of Canada has accepted its responsibilities to the agriculture sector, and we will continue to do so.

We recognized the need to give special consideration to Prairie producers who had endured the cumulative effects of two or more years of drought.

This assistance, added to payouts from the Western Grain Stabilization Program and the federal–provincial Crop Insurance Program, will give Prairie producers more than $1.3 billion this crop year.

Ongoing programs like WGSA and crop insurance form a safety net for producers. I am committed, not only to maintaining these programs, but to making them stronger and more effective.

For crop insurance, I plan to work with the provinces to create a permanent assistance program tied to crop insurance that would give producers additional protection against significant and consecutive losses.

And the WGSA is currently being reviewed by a Parliamentary Committee, which will recommend what changes, if any, are required to make the program more responsive to producers' needs.

Those are two of my priorities. I'd like to tell you about a few more.

First, agricultural research. I believe it is a fundamental development tool for the industry.

It has paid off in the past and it will even more so in the future. For that to happen, we must improve the interplay between scientific researchers, and food processors, farmers and other users of research technology. Our researchers must consult more, think more of the marketplace and place more emphasis on the practical application of research results.

And, as I mentioned earlier, research is one of the areas where we plan to co–ordinate our efforts more closely with the provinces.

During 1986, as my department's research branch celebrates its centennial, I'm hopeful more Canadians will learn about the important contributions federal research scientists have made, and are continuing to make, to the agriculture industry.

My other priorities follow a common theme, that is, the need to strengthen our farm financial structure.

Soil degradation may not at first appear to fit into this category. But, as I mentioned in my opening remarks yesterday, the problem creates very real costs to farmers in terms of reduced yields and increased chemical use. And if you consider its potential threat to our international competitiveness, you'll understand why soil degradation is very much an economic issue.

I've made agricultural stabilization another priority because I firmly believe that tripartite agreements can bring greater financial stability to Canada's red meat producers.

On November 25 I signed with the province of Ontario the first national tripartite agreement for the red meat sector. My goal is full participation by all provinces and commodity groups. I hope this will happen once an impact analysis of programs affecting the red meat sector has been completed, and once any necessary adjustments have been made.

Trade is pocketbook issue for farmers, and I want them to understand why. I want them to appreciate the fact that nearly half of everything they produce is exported. It's essential to the financial well–being of this industry that we improve and secure access to our largest, most diversified and fastest growing market — the United States.

Canada is entering into negotiations with the United States on a new trade arrangement. I believe there are gains to be made in the agriculture trade sector. If that is the case — and only if that's the case — we'll sign a deal for agriculture.

Because exports are so important to Canadian farmers, and because our farmers should not have to compete at home or abroad against the treasuries of other countries, Canada is also preparing for a new round of talks on the General Agreement on Tariffs and Trade. We will continue to insist that agriculture form a meaningful part in these negotiations.

During these talks, we'll be aiming for improved and more secure access to markets, improved international rules on subsidies affecting agricultural trade, and a more universal set of agricultural trade rules that apply equally to all trading countries.

Finally, with respect to farm finance, I plan to move quickly on new initiatives that specifically address the credit needs of Canada's farmers. It's especially important that we co–operate with the provinces in this area so that our efforts are as effective and well–targetted as possible.

I'll be bringing to Cabinet very soon new financial measures through the Farm Credit Corporation that specifically address the financial needs of Canadian farmers. In the meantime, I've placed a moratorium on FCC foreclosure actions. It will remain in effect until such time as these new initiatives have been announced.

In addition, the Minister for Consumer and Corporate Affairs is — with my full support — considering amendments to the Bankruptcy Act to give special consideration to farmers.

Producers facing insolvency need stronger legislation that will bring them together with their creditors to work out reasonable solutions. I consider this an urgent priority, so you can expect an announcement on our course of action shortly.

When you look at some of my priorities — tripartite stabilization, research, and so on — you get a sense of the real challenges we face in meeting the financial needs of the farming community.

It's clear to me — and I hope to you — that our collective long-term efforts must be directed, not just toward assisting farmers in distress, but also toward preventing the circumstances that cause farm bankruptcies in the first place.

Building a stronger, more secure structure of agricultural programs — that is our major policy challenge. I welcome the participation of all governments and all sectors of the industry in rising to meet this challenge.

## CONVERSION FACTORS

| Metric units | Approximate conversion factors | Results in: |
|---|---|---|
| **LINEAR** | | |
| millimetre (mm) | x 0.04 | inch |
| centimetre (cm) | x 0.39 | inch |
| metre (m) | x 3.28 | feet |
| kilometre (km) | x 0.62 | mile |
| **AREA** | | |
| square centimetre ($cm^2$) | x 0.15 | square inch |
| square metre ($m^2$) | x 1.2 | square yard |
| square kilometre ($km^2$) | x 0.39 | square mile |
| hectare (ha) | x 2.5 | acres |
| **VOLUME** | | |
| cubic centimetre ($cm^3$) | x 0.06 | cubic inch |
| cubic metre ($m^3$) | x 35.31 | cubic feet |
| | x 1.31 | cubic yard |
| **CAPACITY** | | |
| litre (L) | x 0.035 | cubic feet |
| hectolitre (hL) | x 22 | gallons |
| | x 2,5 | bushels |
| **WEIGHT** | | |
| gram (g) | x 0.04 | oz avdp |
| kilogram (kg) | x 2.2 | lb avdp |
| tonne (t) | x 1.1 | short ton |
| **AGRICULTURAL** | | |
| litres per hectare (L/ha) | x 0.089 | gallons per acre |
| | x 0.357 | quarts per acre |
| | x 0.71 | pints per acre |
| millilitres per hectare (mL/ha) | x 0.014 | fl. oz per acre |
| tonnes per hectare (t/ha) | x 0.45 | tons per acre |
| kilograms per hectare (kg/ha) | x 0.89 | lb per acre |
| grams per hectare (g/ha) | x 0.014 | oz avdp per acre |
| plants per hectare (plants/ha) | x 0.405 | plants per acre |